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NATIONAL DAM INSPECTION PROGRAM. BELMONT LAKE DAM, NDS ID PA.-0--ETC(U)
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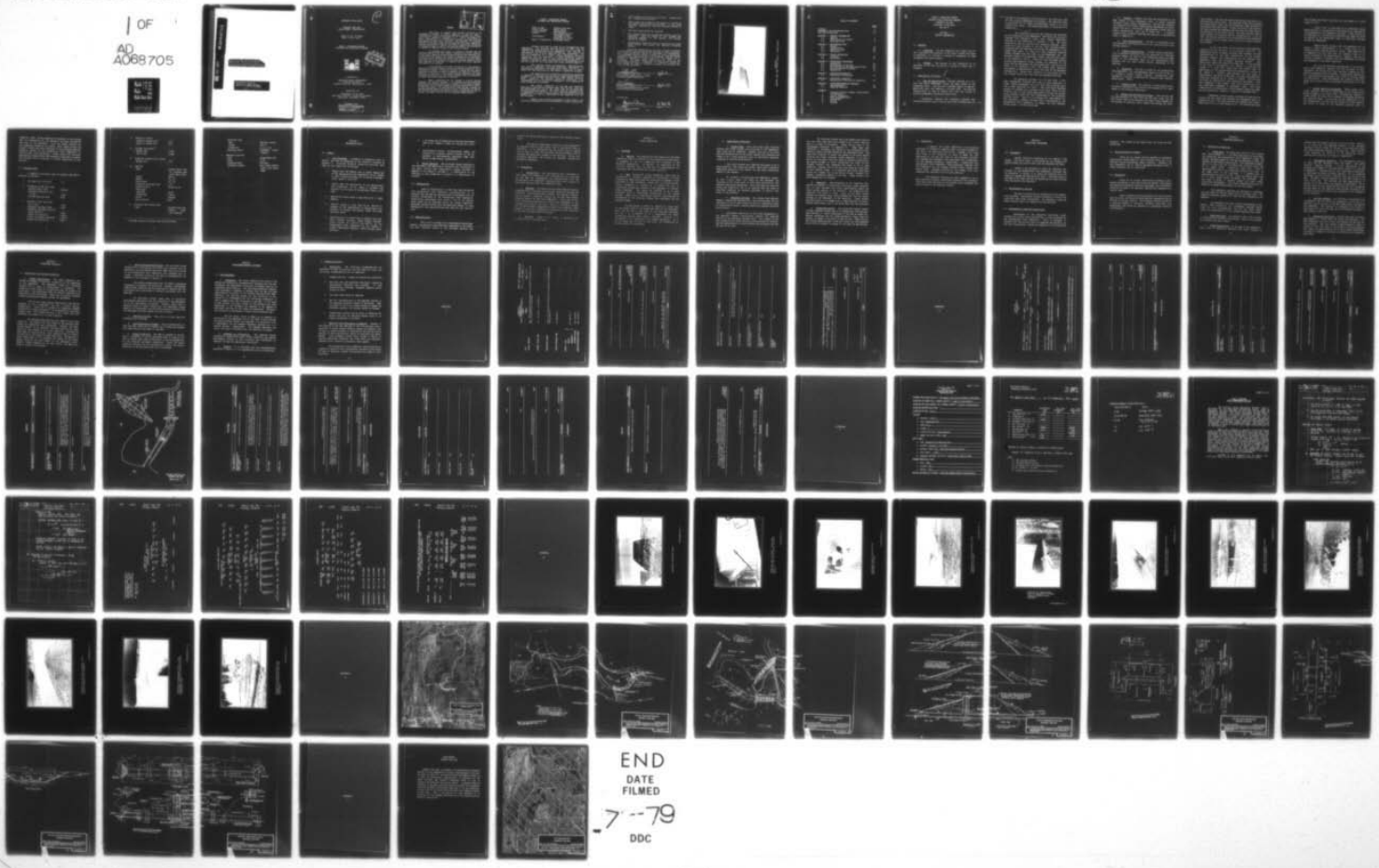

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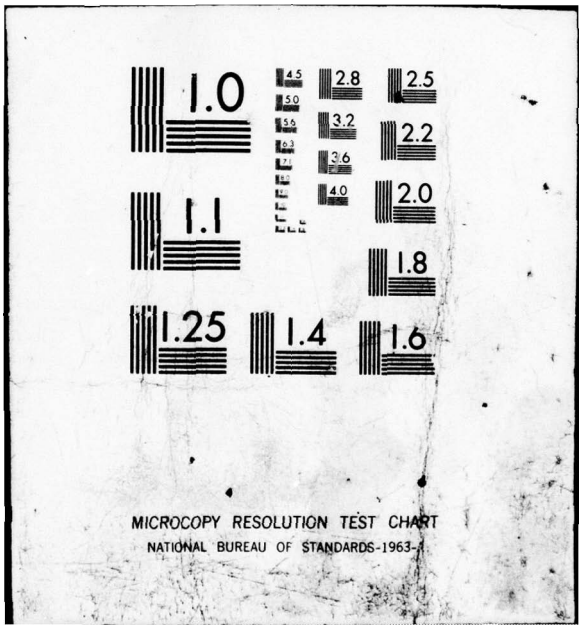
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Belmont Lake Dam, NDS ID PA.-00163,
DER ID 64-21. Delaware River Basin,
W. Branch Lackawaxen River, Wayne County,
Pennsylvania. Phase I Inspection Report.

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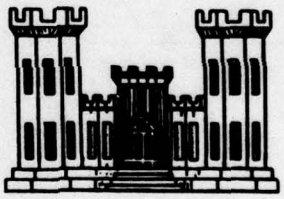
(15)

DELAWARE RIVER BASIN

BELMONT LAKE DAM
WAYNE COUNTY, PENNSYLVANIA

NDS I.D. NO. PA 00163
DER I.D. NO. 64-21

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared by:

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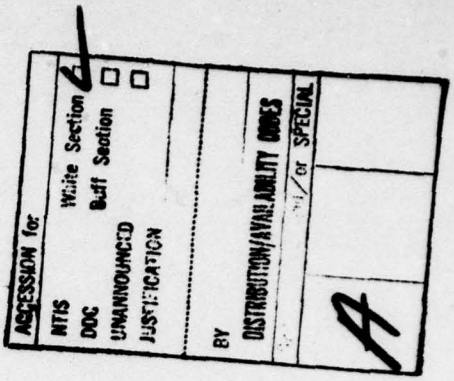
Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

DECEMBER 1978



PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I investigation is to expeditiously identify those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Belmont Lake Dam
County Located:	Wayne County
State Located:	Pennsylvania
Stream:	West Branch of the Lackawaxen River
Coordinates:	Latitude 41° 46.1' Longitude 75° 26.8'
Date of Inspection:	25 October 1978

Belmont Lake Dam is owned by the Pennsylvania Fish Commission. The original dam was built in 1830, and was subsequently covered during the reconstruction of the dam in 1958 by the Pennsylvania Fish Commission. The facility is considered to be in good condition and well maintained. The dam is classified as a "High" hazard potential structure consistent with its potential to cause extensive property damage and possible loss of life downstream in the event of failure. The dam is also classified as an "Intermediate" size dam by virtue of its 3,168 acre-foot total storage capacity.

The limited design documentation, specifications, and visual inspection provided sufficient information to evaluate the embankment and appurtenant facilities in accordance with the provisions of the Phase I inspection program.

The hydrologic and hydraulic calculations presented in Appendix C indicate that the dam will pass approximately 65 percent of the Probable Maximum Flood (PMF) without overtopping. Therefore, the spillway system is considered to be "Inadequate" but not "Seriously Inadequate", as it passes more than 50 percent of the PMF.

The visual inspection of the dam and reservoir detected no significant problems other than two wet areas near the downstream toe and on the right side of the principal spillway discharge channel. The first area was assessed to be a topographic low that collects water; and the second area was assessed to be a spring, reportedly at the location of an old spring house.

Based on the findings presented in this report, the following recommendations are presented in order of priority:

1. Both seepage areas should be drained. Seepage Area No. 2 should be stabilized.

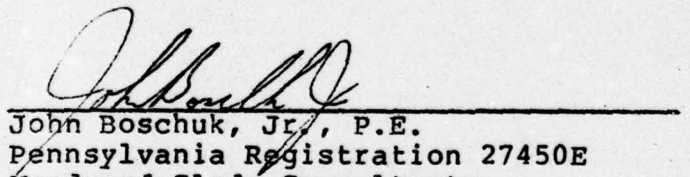
2. Flow rates and turbidity from Area No. 2 should be periodically monitored and recorded. If flow rates increase, appropriate remedial measures should be taken.

3. The check dams should be repaired.

4. Silt accumulations in the approach channel should be monitored. When the depth of silt impedes the discharge capacity of the channel, the channel should be dredged.

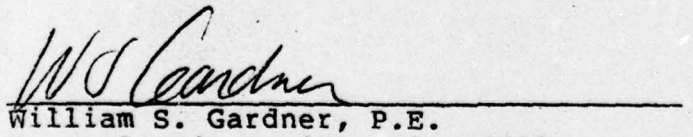
5. Consideration should be given to improving the flood prone access road across the spillway discharge channel.

Since the facilities do not have a formal procedure of observation and warning during periods of high precipitation, such procedures should be developed and implemented. This procedure should include a method of warning downstream residents that high flows are to be expected, together with a method of evacuating these people in the event of an emergency. The Owner should also develop an operation and maintenance procedure, including an inspection checklist, which should be used to regularly inspect and maintain all items of the structure.



25 Jan 79
Date

John Boschuk, Jr., P.E.
Pennsylvania Registration 27450E
Woodward-Clyde Consultants



25 Jan 1979
Date

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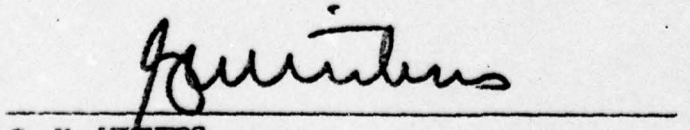
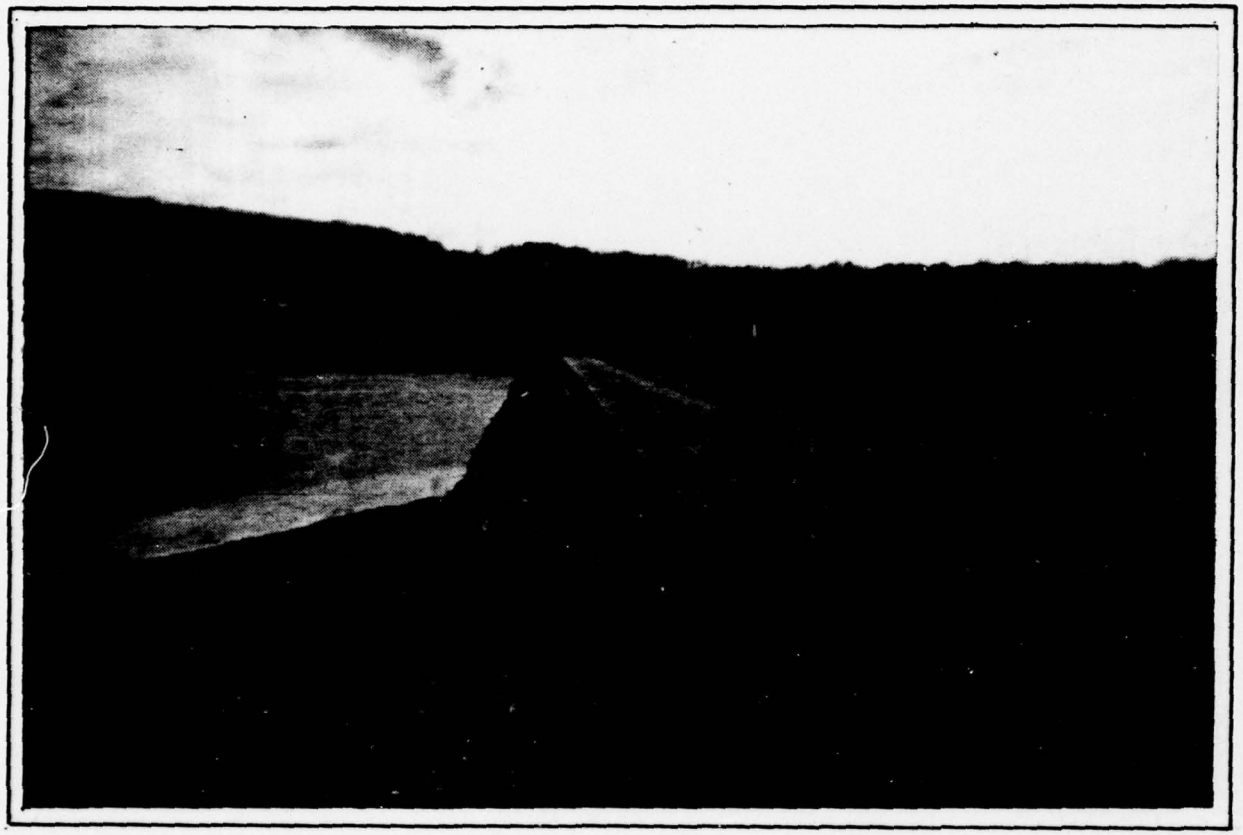


16 Feb 79
Date

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer



OVERVIEW
BELMONT LAKE DAM, WAYNE COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
BELMONT LAKE DAM
NATIONAL ID #PA 00163
DER #64-21

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

ABSTRACT

a. Dam and Appurtenances. Belmont Lake Dam is a 27.5 foot high earth embankment across the West Branch of the Lackawaxen River. The dam has a maximum length of approximately 600 feet, and impounds a 172-acre lake. The dam was reconstructed in 1959 by adding fill over and around an existing embankment constructed about 1830.

Available drawings and literature indicate that drainage blankets, grout curtains and cutoff trenches were not

CONT

included in the design of this structure. The materials used for the original embankment are unknown. The upstream slope is protected with 18 inches of hand-placed riprap on a 6-inch gravel filter layer. The downstream slope is protected with vegetation.

The reconstruction work was designed and performed by the Pennsylvania Fish Commission. The facilities include a standard Fish Commission intake tower located immediately upstream of the centerline at Station 5 + 83. The tower contains an interior overflow weir formed by stoplogs. Water enters the tower through a 4 foot by 4 foot concrete conduit extending from the upstream toe through the embankment to the intake tower base. A 4 foot by 4 foot concrete discharge conduit extends from the tower to the downstream toe. The entrance invert is at elevation 1,924.5, and the exit invert is at elevation 1,923.0. There are two anti-seep collars located approximately midway between the upstream toe and tower and the downstream toe and plunge pool. The top of the tower is at elevation 1,952, and normal pool elevation corresponds to approximately 1,946, the crest of the emergency spillway weir. Normal pool elevation is controlled by both the stoplogs within the tower and the emergency spillway.

The emergency spillway is a 65 foot wide, 3 foot high trapezoidal concrete weir with a crest elevation of 1,946. Water discharges into a 21 foot long stilling basin with a base elevation of 1,941.5. The rock-lined discharge channel is crossed by a concrete ford (with three 24-inch culverts) and six rock check dams before joining the natural stream channel about 600 feet downstream of the principal spillway outlet. There are no minimum flow requirements for this structure. However, minimum flow is maintained by the Pennsylvania Fish Commission to supply the fish hatchery located about 1.7 miles downstream.

b. Location. Belmont Lake Dam was constructed on the West Branch of the Lackawaxen River, in Mount Pleasant Township, Wayne County, Pennsylvania. The dam and reservoir are located on the "Orson, Pennsylvania" Quadrangle at coordinates N 41° 46.1' W 75° 26.8', approximately 3 miles south of Orson, Pennsylvania, just off of Route 670. A regional location plan of Belmont Lake Dam and reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as an "Intermediate" size dam by virtue of its 3,168 acre-foot total storage capacity.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential for extensive property damage and loss of life downstream along the West Branch of the Lackawaxen River at the Pennsylvania Fish Hatchery and the other houses further downstream of the hatchery.

e. Ownership. The dam is owned by the Pennsylvania Fish Commission. All correspondence should be sent to Mr. E. J. Grindall, Senior Project Engineer, Pennsylvania Fish Commission, Division of Engineering, Robinson Lane, Belfont, Pennsylvania 16823.

f. Purpose of Dam. The reservoir is used primarily for recreation associated with fishing and secondarily for water supply to the hatchery downstream.

g. Design and Construction History. The original dam was approximately 25 feet high and 450 feet long, and was built about 1830 by the Delaware and Hudson Canal Company for the purpose of auxiliary water supply and storage for their

canal system. The dam was constructed across the outlet of a pre-existing natural pond. The upstream slope was protected with hand-placed stone and the downstream slope contained a hand-placed dry stone wall. Around the turn of the century, the canal system was abandoned and the pond was drawn down to the elevation of the natural pond. The lake was then used by local farmers for pleasure and for harvesting ice. Prior to 1917, the dam was acquired by the Pennsylvania Fish Commission who replaced the old timber sluice way with a concrete channel and fishway.

In the late 1950s, the Pennsylvania Fish Commission rehabilitated the structure to its present condition. The application report to repair and alter the structure included reconstruction of the dam, construction of the present spillway channel, and construction of the standard Fish Commission tower and principal spillway culvert. This application report was issued on 21 May 1958. It was reviewed by the State of Pennsylvania, and a permit to construct was issued on 11 June 1958, based upon the "Report Upon the Application of the Pennsylvania Fish Commission", written by Mr. James A. Dickson, Dam Engineer for the State of Pennsylvania, and dated 3 June 1958. The plans and specifications were prepared by Mr. Thomas F. O'Hara. The work was performed by Pennsylvania Fish Commission personnel. This work commenced in late summer, 1958, and reconstruction work was reportedly completed in September, 1959. The final inspection by the Department of Environmental Resources (DER) was performed by Mr. Joseph J. Ellam on 16 November 1959.

Embankment reconstruction consisted of removing the riprap from the slopes and stepping the embankment prior to placing new fill. The upstream side was enlarged with Class A impervious fill to a final slope of 3:1. The downstream slope

was stripped and Class B pervious fill was placed on a final slope of 2.5:1.

Class A fill is described as an impervious clayey sandy material of structurally sound quality as approved by the Pennsylvania Fish Commission Engineer. Class B material is described as a structurally sound pervious material which is placed on the downstream slope to facilitate drainage through the embankment.

Specifications required that the embankment fill be placed in layers approximately 4 to 6 inches thick at the standard proctor optimum moisture content. Each layer was to be compacted with not less than six complete trips of the roller as stated in the specifications. However, there are no records available to indicate that the embankment was placed and compacted in the manner specified.

All work was performed by employees of the Pennsylvania Fish Commission between 1958 and the Fall of 1959. Throughout the construction work, periodic inspections were made by representatives of the DER. During these inspections, six black-and-white photographs were taken at various stages of construction. These photographs are located in DER files along with fourteen older photographs dating back to 25 May 1917.

h. Normal Operating Procedures. Under normal conditions, reservoir outflow is controlled by the stoplog weir system located in the intake riser. Stoplogs are inserted in tracks inside the tower and the number of stoplogs determines the reservoir level. At the time of this inspection, all of the stoplogs were in place and the elevation of the reservoir was within 18 inches of the emergency spillway crest at

elevation 1,946. Flows exceeding the capacity of the stoplog weir are discharged over the emergency spillway located 300 feet west of the embankment. Since the wooden stoplogs are not completely sealed at the joints, water seeps through the joints. Valves have been installed in the principal spillway discharge system by the Pennsylvania Fish Commission to control water flow downstream. These valves are routinely regulated by Pennsylvania Fish Commission personnel to assure that minimum flow is achieved to sustain operations at the hatchery.

1.3 Pertinent Data.

A summary of pertinent data for Belmont Lake Dam is presented as follows:

a.	Drainage Area (sq miles)	4.2
b.	Discharge at Dam Site (cfs)	
	Maximum Known Flood	Unknown
	Maximum Discharge at Top of Dam	3,650
	Minimum Required Flow	None
c.	Elevation (feet above MSL)	
	Top of Dam	1,952
	Emergency Spillway Crest	1,946
	Emergency Spillway Stilling Basin End Sill	1,942
	Invert of Pond Drain	1,924.5
	Invert of Conduit Discharge	1,923.0
	Normal Pool Elevation	1,946

d.	Reservoir (miles)	
	Length at Normal Pool	1.4
	Fetch at Normal Pool	0.8
e.	Storage (acre-feet)*	
	Normal Pool	2,035
	Top of Dam	3,168
f.	Reservoir Surface Area (acres)	
	Normal Pool	172
g.	Dam Data	
	Type	Rolled earth over an existing dam built about 1830.
	Length	600 ft
	Height	27.5 ft
	Crest Width	12.0 ft
	Freeboard at Normal Pool	6 ft
	Volume of Fill	40,000 cu yd
	Side Slope	
	Upstream	3H:1V
	Downstream	2.5H:1V
	Cutoff	Unknown
	Grout Curtain	None
h.	Diversion and Intake Riser	
	Type	Standard Fish Commission Tower with stoplogs.

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* Includes volume of natural pond (538 acre-feet).

Discharge Pipe	
Type	Concrete conduit
Length	147 ft
Dimensions	4 ft x 4 ft
Discharge Basin	Riprapped outlet channel.

i. Emergency Spillway

Type	Trapezoidal weir
Width	65 ft
Discharge Basin	Concrete
Discharge Channel	Rock lined channel w/six rock check dams.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of engineering data on Belmont Lake Dam is presented on the checklist attached as Appendix A. Principal documents containing pertinent data used for this report are as follows:

1. "Report Upon the Belmont Lake or Beaver Meadow Dam of the Pennsylvania Fish Commission" by Mr. George S. Beal, Division Engineer for the State of Pennsylvania, dated 21 June 1917.

2. "Report Upon the Application of the Pennsylvania Fish Commission" by Mr. James K. Dickson, Dam Engineer for the State of Pennsylvania, dated 3 June 1958.

3. Application report dated 21 May 1958 by Mr. P. James DeMarte.

4. "Permit" issued 11 June 1958 by Mr. Maurice K. Goddard for the Commonwealth of Pennsylvania, Department of Forests and Waters, Water and Power Resources Board.

5. Specifications for Rebuilding of Belmont Lake Dam, Mount Pleasant Township, Wayne County, Pennsylvania; Project No. P2727-0 and P2727-1 for the Pennsylvania Fish Commission by Mr. Thomas P. O'Hara, Registered Engineer, State College, Pennsylvania.

6. A six-sheet set of construction drawings dated March 1958 by Mr. Thomas F. O'Hara for Project No. P2727-1.

7. Miscellaneous letters, correspondence, memos, and construction progress reports located in the Department of Environmental Resources (DER) main office in Harrisburg, Pennsylvania.

b. Design Features. The principal design features of the embankment and appurtenant structures are illustrated on the plan, profile and cross-section plates enclosed in Appendix E as Plates 2 through 7. A description of the features is also presented in Section 1.2, "Description of Project".

2.2 Construction.

Based on documentation in DER files and discussions with Pennsylvania Fish Commission representatives, it is believed that the dam was reconstructed in accordance with the criteria established by the Pennsylvania Fish Commission. Construction photographs also verify a few of the details which could not be observed during the visual inspection. Available records confirm that the materials similar to those designated in the specifications were used for the construction.

2.3 Operation Data.

There are no minimum flow requirements downstream. However, Pennsylvania Fish Commission employees at the hatchery have installed valves at the principal spillway and

control the downstream flow to maintain fish hatchery operations.

The dam and appurtenant facilities were designed to be operated without a dam tender, and no operational data is available. It is understood that the sluice gate is opened twice a year to clean the principal spillway conduit and to exercise the mechanical systems of the spillway. During this bi-yearly operation, the valves are greased, cleaned and painted as necessary.

2.4 Evaluation.

a. Availability. All engineering data reproduced in this report and studied for this investigation were provided by the DER and supplemented by conversations with the Pennsylvania Fish Commission representatives and a review of the files they provided the inspection team.

b. Adequacy. The design data provided were sufficiently comprehensive to evaluate the pertinent aspects of the dam and reservoir. Construction data, however, was limited, consisting of several inspection reports by the DER and several progress reports by the Fish Commission. There are no "as-built" drawings documenting the constructed embankment or the existence of valves in the riser. Even so, this data, coupled with the photographic documentation and visual inspection, were adequate to provide a judgemented evaluation of the condition of the dam and appurtenant structures.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B, and are summarized and evaluated in the following subsections. In general, the appearance of the facility indicates that the dam and its appurtenances are reasonably well maintained and in good condition.

b. Dam. During the visual inspection, there were no indications or evidence observed of distortions in crest alignment or grade that would be indicative of movement of the embankment or the foundation. There were no surface cracks, unusual movements or cracking at or beyond the toe, or significant sloughing or erosion of the embankment or abutment slopes observed. The riprap was observed to be in good condition with no significant distortions of the riprap surface. There was no significant erosion, deterioration or degradation of the junctions between the embankment and the abutment slopes.

As delineated on Sheet 5a, Appendix B, there were two wet areas noted on the downstream side of the embankment below the toe and to the right of the principal spillway. Area No. 1 is considered to be a topographic low which temporarily retards water after a rainfall. Area No. 2 is considered to be associated with seepage emergence. As a spring house once existed in this area, the possibility of springs cannot be discounted.

c. Appurtenant Structures.

1. Intake Tower. Since the intake tower discharge conduit and intake conduit are contained in the embankment, they could not be inspected. However, the top of the tower and the discharge end of the outlet system were inspected and found to be in good condition with no significant spalling, cracking or concrete deterioration.

The outlet channel was inspected and found to be in good condition. The riprap was stable, there was no excessive vegetation growing in the riprap, nor was there significant debris in the channel.

Mr. Grindall, Pennsylvania Fish Commission, reported that a drain valve, not shown on any drawings, was installed in the intake tower to allow water draw-off for fish hatchery operations downstream. This valve was not exercised during the inspection, but it is reported that the valve is exercised regularly by hatchery personnel to control flow rates to the hatchery.

2. Emergency Spillway. The riprap-lined approach channel, trapezoidal concrete weir, and stilling basin are all considered to be in good condition with no significant signs of riprap deterioration, concrete spalling or general concrete deterioration.

Significant quantities of silt have accumulated in the approach channel, particularly against the upstream section of the emergency spillway weir. As a result of the silt accumulations, grass has been growing across the channel, leaving approximately 18 inches between the spillway crest and the top of the silt.

The discharge channel below the access road contains six rock check dams which were judged to be in poor condition and in a state of disrepair. These can be seen in the photographs presented in Appendix D. These dams were installed to dissipate the energy of the discharging water before it enters the West Branch of the Lackawaxen River. The dams still function to reduce the energy of the water before entering the creek; although, unless repaired, it is only a matter of time before they will cease to function effectively. The access bridge, or ford, containing the three 24-inch diameter culverts was inspected and found to be in good condition. However, due to the fact that there are only three 24-inch diameter pipes, it is expected that water would pond behind the roadway and, during severe storms, inundate this roadway, preventing access to the dam. These culverts are also susceptible to clogging.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability, or other features that would significantly affect the flood storage capacity of the reservoir. All slopes are well vegetated with grass or trees. There is one major stream feeding into Belmont Lake, which branches off into two lesser streams at the headwaters of the reservoir. These streams basically drain a low swampy area of approximately 110 acres. Several small ponds, one or two acres each, dot the watershed.

e. Downstream Channel. The downstream channel passes through a densely wooded area to a Pennsylvania Fish Hatchery approximately 1.7 miles downstream of the dam at Route 371. Several buildings and the superintendent's house would be subject to damage in the event of dam failure. There are two more houses approximately 1,000 feet below the fish hatchery which would be subject to damage in the event of dam failure.

3.2 Evaluation.

In summary, the visual inspection of the structure disclosed no evidence of apparent past or present movement of the dam or its appurtenant facilities. Seepage or wet areas were noted at two locations, as shown on Sheet 5a, just downstream of the dam and right of the principal spillway. This seepage was assessed to be associated with a topographic low and seepage emergence, respectively. Discussions with Pennsylvania Fish Commission representatives indicate that the topographic low and seepage existed without change since before 1969. Exposed portions of the intake riser were inspected and observed to be in good condition.

The emergency spillway was also assessed to be in good condition; however, significant amounts of silt accumulations were noted upstream of the spillway crest throughout the entire length of the approach channel.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures.

Normal operating procedures do not require a dam tender. The water level is maintained by the stoplog weir system inside the control tower and the emergency spillway.

Should it be necessary to lower the reservoir, Mr. Grindall of the Pennsylvania Fish Commission indicated that the procedure, in theory, is to remove the stoplogs until the reservoir reaches the desired water level. The sluice gate at the base of the tower can also be opened and the water drained from the base of the reservoir.

4.2 Maintenance of the Dam.

The dam is maintained by Pennsylvania Fish Commission personnel. Maintenance normally consists of cutting the grass and other minor maintenance. As necessary, trash and other floating debris is removed from the shoreline.

4.3 Maintenance of Operating Facilities.

Maintenance of the operating facilities, which includes the intake tower and spillway, is also performed by the Pennsylvania Fish Commission. There is evidence to indicate that the control tower is inspected periodically, as the valve was painted, greased and appeared to be functioning

properly. The inside of the intake tower was clean and well maintained.

4.4 Warning Systems In Effect.

There are no formal warning systems or procedures specifically established for this structure which are to be followed during exceedingly heavy rainfalls. However, the Fish Commission has an interim emergency procedure until a formal procedure can be instituted.

4.5 Evaluation.

There are no written operational procedures, maintenance procedures or any type of warning system. Maintenance and operating procedures should be developed, which includes a checklist of items to be observed, operated and inspected on a regular basis.

Since a specific warning procedure for this facility does not exist, one should be developed and implemented during periods of extreme rainfall. This procedure should consist of a detailed method of notifying residents downstream that potentially high flows are imminent or a dangerous condition is developing.

SECTION 5

HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. No design data exists for the original dam. From information in the State Department of Environmental Resources and Pennsylvania Fish Commission files, the present spillway system for the dam was designed in 1949, and checked in 1958 before construction. The watershed is small, about 2.8 miles long and 1.5 miles wide, having a total area of 4.2 square miles. Elevations range from a high of approximately 2,656 to the normal pool elevation of 1,946. In the upper half of the watershed is a marshy area of approximately 110 acres in area. There are several small (one to two acre) ponds dotted throughout the watershed. The watershed is about 75 percent wooded with very little residential development. The runoff characteristics are not expected to change significantly in the near future.

This emergency spillway was designed to discharge not less than 760 cfs per square mile of drainage area. The computed discharge capacity of 3,185 cfs was considered to be adequate.

In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design flood for this "Intermediate" size dam and "High" hazard potential classification is the Probable Maximum Flood (PMF).

b. Experience Data. No reservoir water level records or precipitation records are maintained. There is no estimate of previous high water levels.

c. Visual Observations. On the date of the inspection, there were no conditions observed that would indicate a

reduced spillway capacity during a flood occurrence. However, it is noted that the approach channel of the emergency spillway is quite silted in, and may in time adversely affect the flood discharge capacity of the spillway. Other observations regarding the condition of the downstream channel, spillway and reservoir are located in Appendix B.

d. Overtopping Potential. The overtopping potential of this dam was estimated using the "HEC-1, Dam Safety Version", computer program. A brief description of the program and a summary of the dam safety analysis are included in Appendix C. Calculations for this investigation essentially confirmed the design spillway capacity, with an estimated discharge of 3,650 cfs and a reservoir level at the top of the dam. The HEC-1 program computed the peak PMF inflow to be about 8,030 cfs. The spillway can pass approximately 65 percent of the PMF without overtopping the embankment. The 65 percent value is very conservatively derived, as no allowance has been made for the temporary flood storage afforded by the 110-acre marshy area located just upstream of the headwaters of the reservoir.

e. Spillway Adequacy. The spillway is considered to be "Inadequate" but not "Seriously Inadequate" as the dam will pass more than 50 percent of the PMF storm without overtopping the embankment. The tailwater is estimated to be 22 feet or more below the top of the dam when the spillway discharge is approximately 3,650 cfs.

f. Downstream Conditions. Belmont Lake Dam is located approximately 1.7 miles above the State Fish Hatchery. The Fish Commission owns all of the land between the dam and the fish hatchery. The fish hatchery superintendent's house is located on the right side of the stream at the fish hatchery and, along with approximately two or three houses downstream, is subject to damage in the event of dam failure or abnormally high flows.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The field inspection disclosed no evidence of potential instability of the embankment or its components. The embankment slopes are reasonably uniform with no signs of displacement or sloughing. The condition of the riprap on the upstream slope was judged to be quite good. The downstream slope was densely vegetated with grass and is well maintained. There was no exterior evidence indicating anomalous seepage through the embankment.

The two wet areas located downstream of the dam are assessed to be a topographic low and a natural spring, respectively. There was no evidence of discolored seepage indicative of piping processes or of progressively increasing seepage flows. The exposed portions of the intake riser were inspected and judged to be in good condition.

The emergency spillway was also judged to be in good condition. The channel and side slopes of the spillway were stable and apparently well maintained. However, the downstream channel of the emergency spillway contains six check dams which were judged to be in poor condition. Although the check dams are deteriorating, their condition does not affect the ability of the channel to pass high flows. The purpose of these check dams is to dissipate the energy of the water before entering the West Branch of the Lackawaxen River. However, unless repaired in the near future, the dams will cease to function as designed.

b. Design and Construction Data. All available design documentation, calculations and other data received from the Department of Environmental Resources (DER) and from the files of the Pennsylvania Fish Commission were assessed and reviewed. A detailed listing of this data is included herein as Appendix A and discussed in Section 2.

The design documentation was, by itself, considered inadequate to evaluate the structure. However, photographs taken by DER inspectors during construction indicate that the structures were constructed in general accordance with the drawings.

As previously stated, there were no structural calculations associated with the stability of the embankment or of the appurtenant structures. However, there were no observed signs of slope instability, the embankment slopes appear to be reasonable, and the service record indicates that the embankment has been stable for over 20 years.

c. Operating Records. There are no written operating procedures for this dam.

d. Post-Construction Changes. Since reconstruction in 1958 and 1959, there are no reports nor is there any evidence that modifications were made to this dam.

e. Seismic Stability. The dam is located in Seismic Zone 1. Normally, it can be considered that if a dam in this zone is stable under static conditions, it can be assumed safe for any expected earthquake conditions. Since the static stability analysis was not available for review, the seismic stability of the dam could also not be evaluated.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. The visual inspection and review of the design and construction documentation indicates that the dam, foundation and appurtenant structures of Belmont Dam are in reasonably good condition. The hydrologic/hydraulic computations presented in Appendix C indicate that the dam will pass approximately 65 percent of the Probable Maximum Flood (PMF). Therefore, the spillway system for this structure is considered to be "Inadequate" but not "Seriously Inadequate" in that it passes more than 50 percent of the PMF. In the event of dam failure, the home located at the hatchery and those downstream of the hatchery are expected to be damaged or destroyed, and loss of life cannot be discounted. Therefore, the structure is considered a "High" hazard potential dam.

The wet areas, noted on Sheet 5a of Appendix B, downstream of the embankment and to the right of the principal spillway discharge channel were assessed to be associated with a topographic low and seepage emergence (perhaps due to a natural spring), respectively. The seepage emergence was clear, and there is evidence that the condition is stable.

b. Adequacy of Information. The combined design information, construction data, visual inspection and obvious performance history of this structure were sufficient to evaluate the dam and appurtenant facilities.

c. Urgency. It is concluded that the recommendations presented in Section 7.2 be implemented as soon as practical.

7.2 Remedial Measures.

a. Facilities. The following recommendations are presented in order of priority, but this does not infer that the latter recommendations are not important.

1. Seepage Area No. 2 should be drained and stabilized.

2. The flow rate and turbidity from Area 2 should be periodically monitored and recorded. If flow significantly increases, necessary remedial action should be taken.

3. The check dams should be repaired.

4. The silt accumulations in the approach channel to the emergency spillway should be monitored. When the depth of the silt is great enough to impede the discharge capacity, the channel should be dredged.

5. Consideration should also be given to improving the access road over the spillway channel since it is highly susceptible to flooding.

b. Operation and Maintenance Procedures. Because of the location of the dam upstream of the fish hatchery with a potential to cause extreme property damage and possible loss of life, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should also include a method of warning downstream residents that high flows are expected, together with a method of evacuating these people.

The Pennsylvania Fish Commission should develop an inspection checklist and a maintenance procedure which would be used to regularly inspect and maintain all items of this structure.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Belmont Lake Dam*

ID # *PA 00163*

ITEM	REMARKS
AS-BUILT DRAWINGS	*Yes. The Pennsylvania Fish Commission provided the inspection team with a six sheet set of drawings.*
REGIONAL VICINITY MAP	*Yes. See Plate 1 of Appendix E.*
CONSTRUCTION HISTORY	*Some of the construction history was provided by the Pennsylvania Fish Commission.*
TYPICAL SECTIONS OF DAM	*See Appendix E.*
OUTLETS - PLAN	*See Appendix E*
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	*None available*
RAINFALL/RESERVOIR RECORDS	*None available*

ITEM	REMARKS
DESIGN REPORTS	*None available - Pennsylvania Fish Commission representative indicated that they were lost over the years.*
GEOLOGY REPORTS	*None avialable.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*None available from the State DER files or the Owner.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*None available.*
POST-CONSTRUCTION SURVEYS OF DAM	*None*
BORROW SOURCES	*Unknown*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*Reconstruction in 1958 and 1959 modified the original dam. See text of report for further discussions.*
HIGH POOL RECORDS	*Not available.*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None*
MAINTENANCE OPERATION RECORDS	*None*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*See Appendix E.*
OPERATING EQUIPMENT PLANS & DETAILS	*See Appendix E.*
MISCELLANEOUS	1. *Permit dated 11 June 1958 by M.K. Goddard to reconstruct existing dam.* 2. *Application filed 21 May 1958* 3. *1964 inspection report by Charles H. Zinn, DER.* 4. *"Report Upon the Application for Reconstruction" dated 3 June 1978 by James A. Dickson.* 5. *Specifications for Rebuilding Belmont Lake Dam by Thomas O'Hara.*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Belmont Lake* County *Wayne* State *Pennsylvania* National ID # *PA 00163*

Type of Dam *Earth* Hazard Category *I (High)*

Date(s) Inspection *25 Oct. 1978* Weather *Clear, Cold, Windy* Temperature *30's*

Pool Elevation at Time of Inspection *1944.5* M.S.L. Tailwater at Time of Inspection *1923.1* M.S.L.

Inspection Personnel:

Mary Beck (Hydrologist)
Vincent McKeever (Hydrologist)
John H. Frederick
John Boschuk, Jr. (Geotechnical/Civil)
Raymond Lambert (Geologist)

John Boschuk, Jr. Recorder

Remarks:

Messrs. E.J. Grindall, Charles Rupert and Robert Martin from the Pennsylvania Fish Commission were on site and provided assistance to the inspection team.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*N/A*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*N/A*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*N/A*	

CONCRETE/MASONRY DAMS

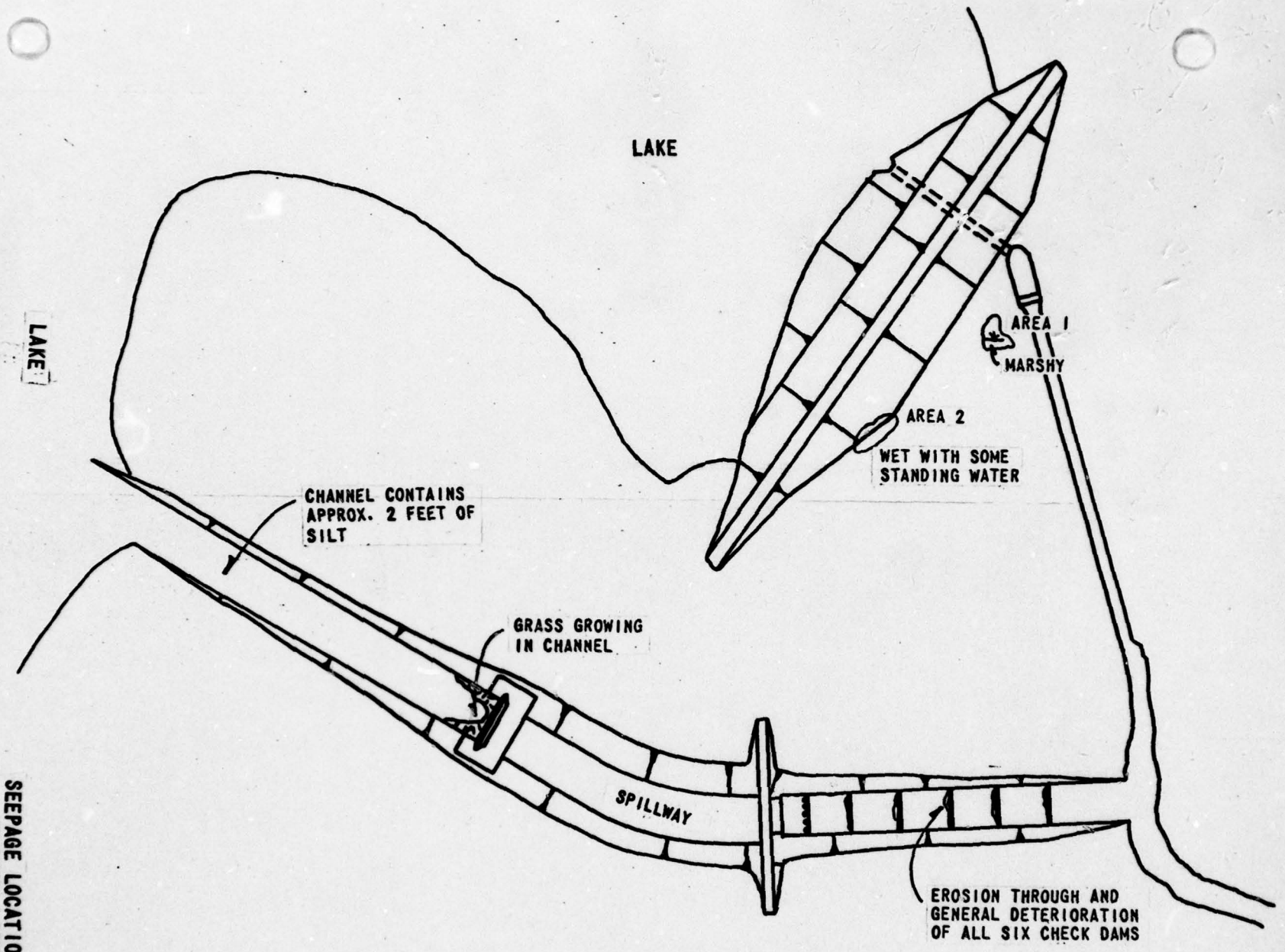
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*None observed.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*The vertical and horizontal alignment was checked and no unusual movements were observed.*	
RIPRAP FAILURES	*None observed. The riprap was observed to be in good condition.*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*No significant erosion, deterioration or degradation of the junctions were observed.*	
ANY NOTICEABLE SEEPAGE	*There were two wet areas noted on the downstream side of the embankment below the toe and to the right of the principal spillway. See Sheet 5a. Area number 1 is considered a topographic low and area number 2 is considered to be a spring (seepage) area. Area No. 2 should be stabilized and drained.*	
STAFF GAGE AND RECORDER	*None found.*	
DRAINS	*There are no piped drainage outlets for embankment seepage shown on the design drawings. See typical section in Appendix E. There were no embankment drainage systems noted in the field.*	



SEEPAGE LOCATION PLAN
BELMONT LAKE DAM

SHEET 5a OF 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*The outlet pipe was found to be in good condition.*	
INTAKE STRUCTURE	*The accessable portions of the intake tower were inspected and found to be in good condition. The portion embedded in the embankment could not be inspected nor could the interior of the tower below the water level be inspected.*	
OUTLET STRUCTURE	*The outlet pipe was found to be in good condition.*	
OUTLET CHANNEL	*The channel was inspected and found to be in good condition.*	
EMERGENCY GATE	*It was reported by Mr. Grindall that a drain valve was installed so water could be drawn off for the fish hatchery downstream. This valve could not be located on the drawings nor was the valve exercised during the inspection. It is reported that the valve is exercised regularly to control flow rates to the hatchery.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*The trapezodial weir was inspected and found to be in good condition. Similarly, the slope paving on each side of the weir was found to be in good condition.*	
APPROACH CHANNEL	*The approach channel is in good condition.*	
DISCHARGE CHANNEL AND ROCK CHECK DAMS	*The discharge channel was found to be in good condition but the six rock check dams were observed to be in poor condition. See photographs in Appendix D. All were in a state of disrepair. Although it is not considered to be critical, the check dams should be repaired.*	
BRIDGE AND PIERS	*The access bridge approximately 300 feet downstream of the spillway was assessed to be in good condition.*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*None*	
APPROACH CHANNEL	*None*	
DISCHARGE CHANNEL	*None*	
BRIDGE AND PIERS	*None*	
GATES AND OPERATION EQUIPMENT	*None*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*A V-notch measuring weir is at the end of the outlet conduit. Flow records were not available.*	
PIEZOMETERS	*None*	
OTHER	*None*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Reservoir slopes are moderate to steep and wooded.*	
SEDIMENTATION	*Minimal sedimentation, no effect on flood water storage.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*The channel meanders through a wooded flood plain. There is little debris in the channel.*	
SLOPES	*The valley gradient is 0.005.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*About 1.7 miles below the dam the West Branch of the Lackawaxen River enters a Pennsylvania State fish hatchery. Several buildings and the superintendants house would be subject to damage in the event of a dam failure. About 1000 feet below the fish hatchery are two more houses which would be subject to damage.*	

APPENDIX

C

BELMONT LAKE DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *75% wooded, very little residential development*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *1,946 ft (2,035 Acre-ft)*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *1,952 ft (3,168 Acre-ft)*

ELEVATION MAXIMUM DESIGN POOL: --

ELEVATION TOP DAM: *1,952 ft*

SPILLWAY

a. Elevation *1,946.0*

b. Type *Trapezoidal weir*

c. Width *65 ft*

d. Length --

e. Location Spillover *Right abutment*

f. Number and Type of Gates *None*

OUTLET WORKS:

a. Type *Standard Fish Commission Riser*

b. Location *Station 4 + 83 of Dam*

c. Entrance inverts *N/A. Stop-logs determine elevation*

d. Exit inverts *1,923±*

e. Emergency draindown facilities *Sluice Gate at Base of Riser*

HYDROMETEOROLOGICAL GAGES:

a. Type *None*

b. Location *N/A*

c. Records *N/A*

MAXIMUM NON-DAMAGING DISCHARGE: *2,160 cfs through bridge at fish hatchery.*

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 12/4/78
By: MFB
Sheet: 2 of 10

DAM Belmont Lake Dam Nat. ID No. PA00163 DER No. 64-21

ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1. Min. Crest Elev., ft.	1952		
2. Freeboard, ft.			
3. Spillway(1) Crest Elev, ft.	1946		
3a. Secondary(2) Crest Elev, ft.			
4. Max. Pool Elev., ft.			
5. Max. Outflow(3), cfs	3184		3649
6. Drainage Area, mi^2	4.19		4.2
7. Max. Inflow(4), cfs			8033
8. Reservoir Surf. Area, Acre	172		172
9. Flood Storage(5), Ac-Ft	1133		

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

(1) Main emergency spillway.

(2) Secondary ungated spillway.

(3) At maximum pool, with freeboard, ungated spillways only.

(4) For columns B, C, use PMF.

(5) Between lowest ungated spillway and maximum pool.

Date: 12/4/78
By: MFB
Sheet: 3 of 10

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from Sheet 2)	Source
1A, 3A	Drawings dated 1/8/58
6A, 7A, 8A, 9A	Calculations dated 1958
6C, 8C	From USGS Map Orson, PA (1978)
7C	See sheet 11
5C	See sheet 10

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

BY MFB DATE 12/4/78 SUBJECT Belmont Lake Dam Hydrology / Hydraulics SHEET 5 OF 10

CHKD. BY [signature] DATE 12/11/78 JOB No.

Classification (Ref. - Recommended Guidelines for Safety Inspection of Dams)

1. The hazard potential is rated as "High" as there would be loss of life if the dam failed.

2. The size classification is "Intermediate" based on its 29 ft. height and 3160 Ac-Ft. total storage.

3. The spillway design flood, based on size and hazard classification, is the Probable Maximum Flood (PMF).

Hydrology and Hydraulic Analysis

1. Design data. The spillway was designed to discharge not less than 760 cfs/sq. mile of drainage area, or 3184 cfs.

Spillway capacity. The C was assumed to be 3.33, (conc. sill), Length = 65 ft and a maximum head of 6 ft.

$Q = C L H^{3/2}$

$Q = 3.33 \cdot 65 \cdot 6^{3/2}$ (design)

$Q = 3185$ cfs ✓

(3181) ✓

There was no futher hydrologic / hydraulic design.

2. Evaluation of present structure was by the use of the computer program. Computer input data as follows:

Inflow hydrograph

rainfall - ref. Hydrometeorological Report No. 33

Synder's hydrograph parameters, t_p & C_p

$t_p = C_t (L L_{ca})^{0.3}$

$C_t = 1.23$ Information received from Corps of Engineers, Baltimore District

$C_p = 0.45$

$L = 1.33$ From USGS map

$L_{ca} = 3.36$

$t_p = 1.23(1.33 \cdot 3.36)^{0.3} = 1.93$ ✓

Reservoir routing

elevation - storage data, taken from the 1958 calculations and shown on sheet 10 ✓

elevation - discharge data, shown on sheet 10 ✓

$Q = C L H^{3/2}$ assuming constant $C \& L$

$C = 3.82$ ref. Brater & King Handbook of Hydraulics Table 5-9 ✓

$L = 65$ ft field checked ✓

Overtopping potential - as shown on sheet 11, the spillway discharges 0.6 PMF but is overtopped by 0.8 PMF

Spillway adequacy, the spillway is rated as "Inadequate" but not "Seriously Inadequate".

3 Estimate of capacity of downstream bridge (Cat fish hatchery)

Use Manning's equation ✓ ✓ ✓

Channel is 28 ft. wide and 5±ft deep, $n = 0.03$

$$Q = a \frac{1.486}{n} \left(\frac{a}{w.p.}\right)^{2/3} s^{1/2}$$

$s = 0.017$ (from USGS map)

$$Q = 28.5 \frac{1.486}{0.03} \left(\frac{28.5}{38}\right)^{2/3} 0.017^{1/2}$$

≈ 2140 cfs ✓

MFB 12/4/78 Belmont Lake Dam Hydrology / Hydraulics SH. 7 OF 10

```
1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  21 AUG 78
 **********************************

 RUN  DATE* 78/11/29.
      TIME* 10.21.22.
```

BELMONT LAKE DAM
NAT ID NO. PA 00163 DER NO. 64-21
OVERTOPPING ANALYSIS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	15	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1

RTIOS= .40 .50 .60 .80 1.00

********** ********** ********** ********** **********

MFB 12/4/78 Belmont Lake Dam Hydrology / Hydraulics SH. 8 OF 10

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO BELMONT LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
IN	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	4.20	0.00	4.20	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.00	111.00	123.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	.06

UNIT HYDROGRAPH DATA

TP= 1.93 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 70 END-OF-PERIOD ORDINATES, LAG= 1.93 HOURS, CP= .45 VOL= 1.00

26.	98.	199.	319.	441.	542.	610.	638.	616.	569.
525.	484.	447.	412.	380.	351.	324.	298.	275.	254.
234.	216.	200.	184.	170.	157.	145.	133.	123.	114.
105.	97.	89.	82.	76.	70.	65.	60.	55.	51.
47.	43.	40.	37.	34.	31.	29.	27.	25.	23.
21.	19.	18.	16.	15.	14.	13.	12.	11.	10.
9.	9.	8.	7.	7.	6.	6.	5.	5.	5.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.34	20.60	1.74	207238.
										(568.)	(523.)	(44.)	(5868.33)

MFB 12/4/78 Belmont Lake Dam SH. 9 OF 10
Hydrology / Hydraulics

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
OBL	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	2035.	-1

STAGE	1946.0	1947.0	1948.0	1949.0	1950.0	1951.0	1952.0	1954.0	1956.0
FLOW	0.	248.	702.	1290.	1980.	2776.	3649.	5618.	7851.
CAPACITY=	538.	1120.	2035.	3168.	3930.				
ELEVATION=	1935.	1940.	1946.	1952.	1956.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1946.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1952.0	2.5	1.5	590.

PEAK OUTFLOW IS 1969. AT TIME 20.25 HOURS

PEAK OUTFLOW IS 2581. AT TIME 20.25 HOURS

PEAK OUTFLOW IS 3204. AT TIME 20.00 HOURS

PEAK OUTFLOW IS 4972. AT TIME 19.50 HOURS

PEAK OUTFLOW IS 6909. AT TIME 19.00 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .40	RATIO 2 .50	RATIO 3 .60	RATIO 4 .80	RATIO 5 1.00
HYDROGRAPH AT	IN	4.20	1	3213.	4017.	4820.	6427.	8033.
		(10.88)	(	90.99)(	113.74)(	136.49)(	181.98)(	227.48)(
ROUTED TO	OBL	4.20	1	1969.	2581.	3204.	4972.	6909.
		(10.88)	(	55.75)(	73.09)(	90.71)(	140.79)(	195.64)(

1

SUMMARY OF DAM SAFETY ANALYSIS

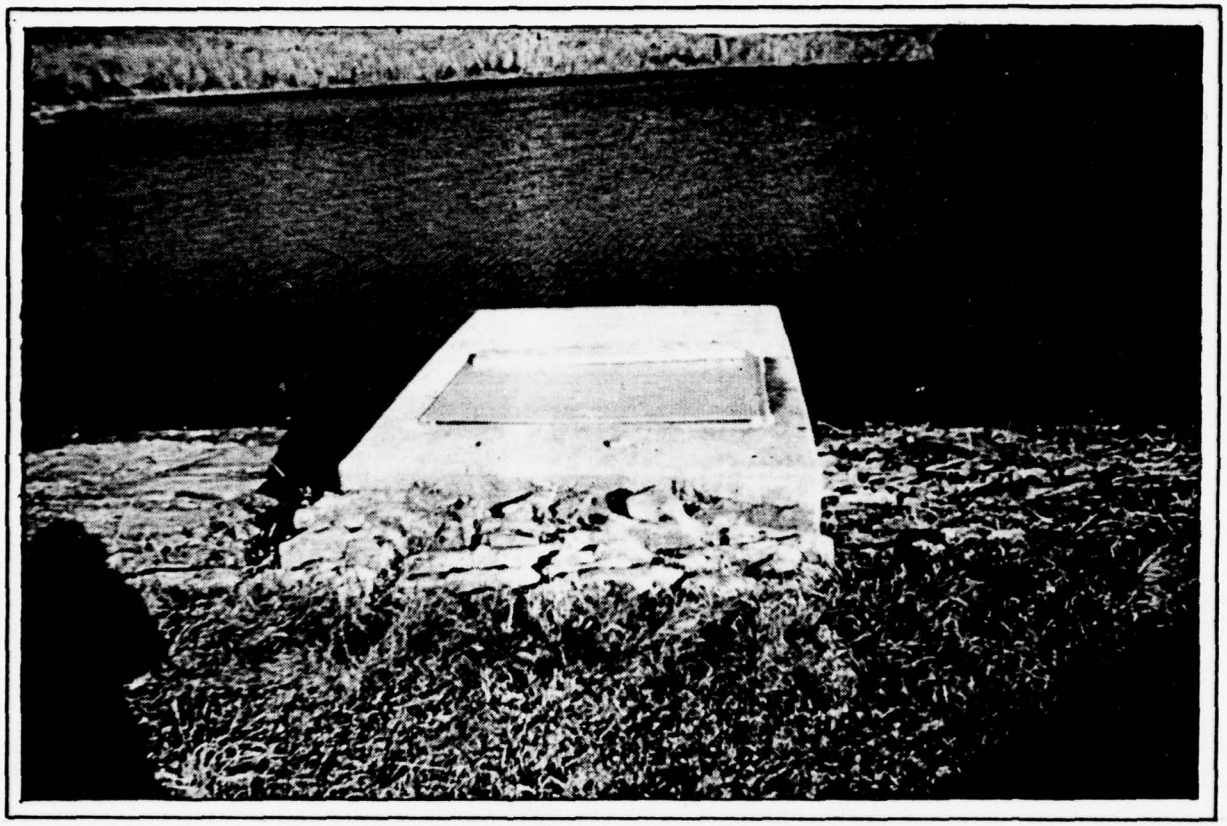
PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1946.00	1946.00	1952.00
STORAGE	2035.	2035.	3168.
OUTFLOW	0.	0.	3649.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1949.98	0.00	2787.	1969.	0.00	20.25	0.00
.50	1950.76	0.00	2933.	2581.	0.00	20.25	0.00
.60	1951.49	0.00	3072.	3204.	0.00	20.00	0.00
.80	1952.62	.62	3286.	4972.	3.25	19.50	0.00
1.00	1953.24	1.24	3404.	6909.	4.75	19.00	0.00

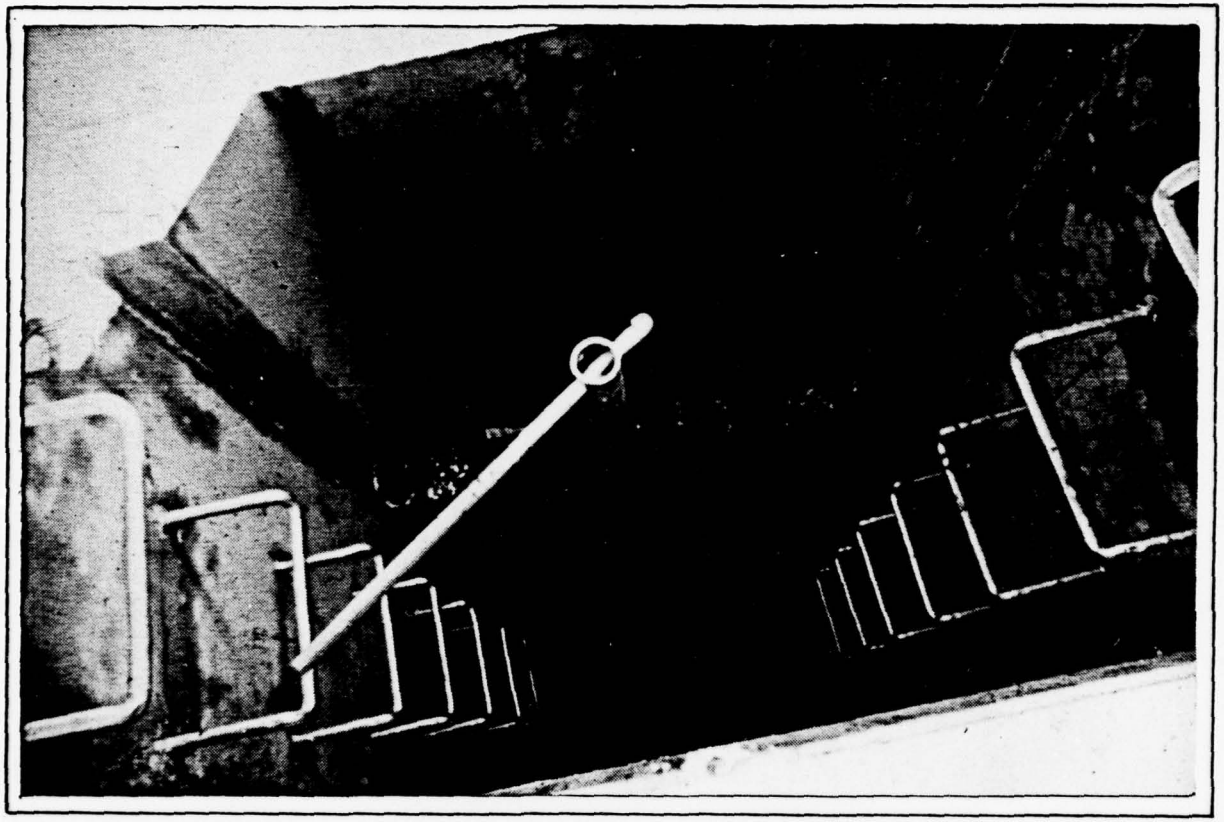
APPENDIX

D



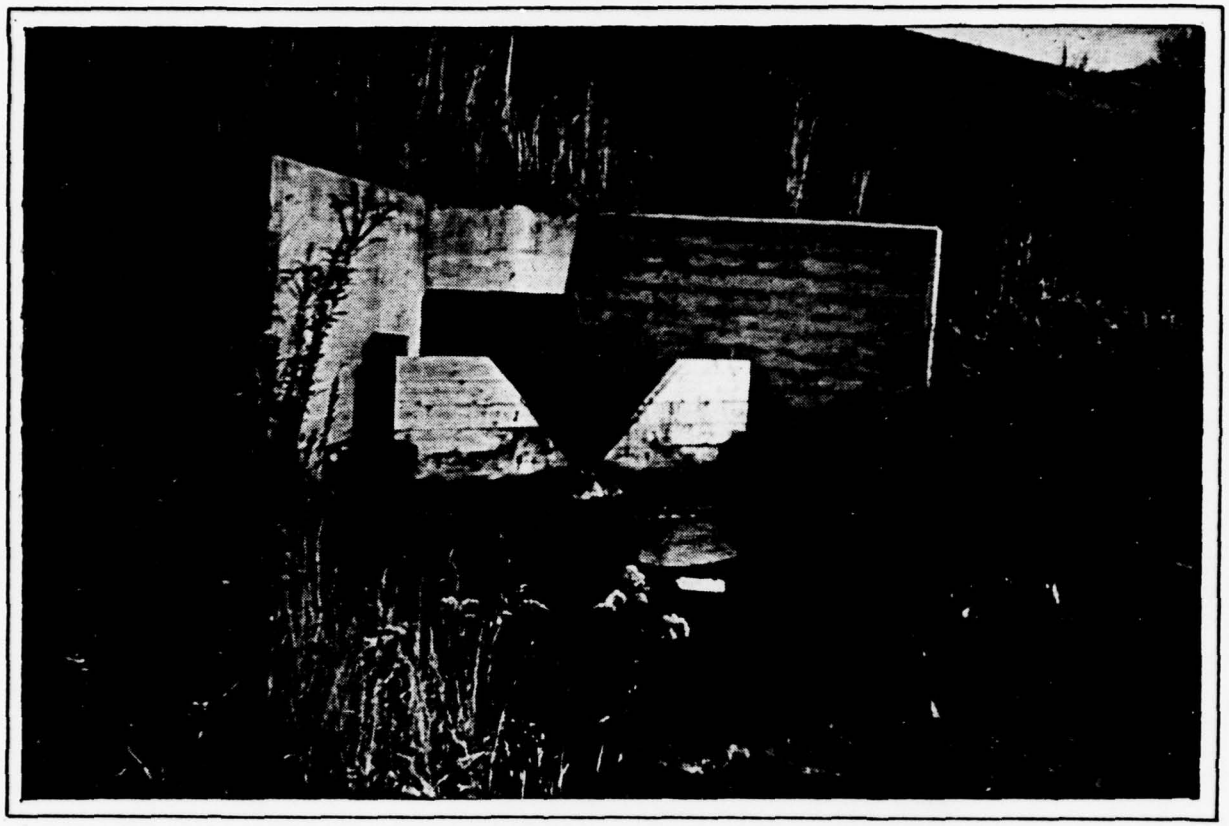
PRINCIPAL SPILLWAY RISER.

PHOTOGRAPH NO. 1



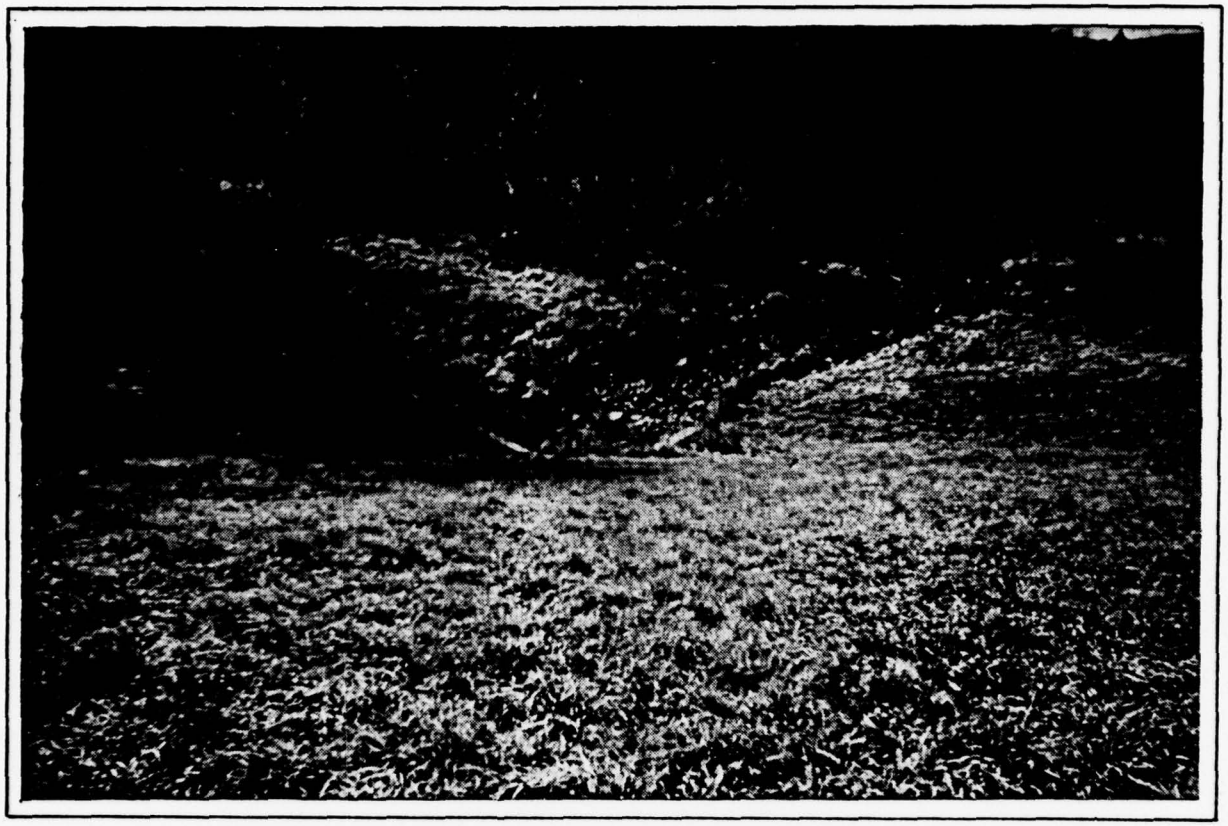
INTERIOR VIEW OF RISER. NOTE WOOD STOP LOGS AND VALVE HANDLE FOR POND DRAIN.

PHOTOGRAPH NO. 2



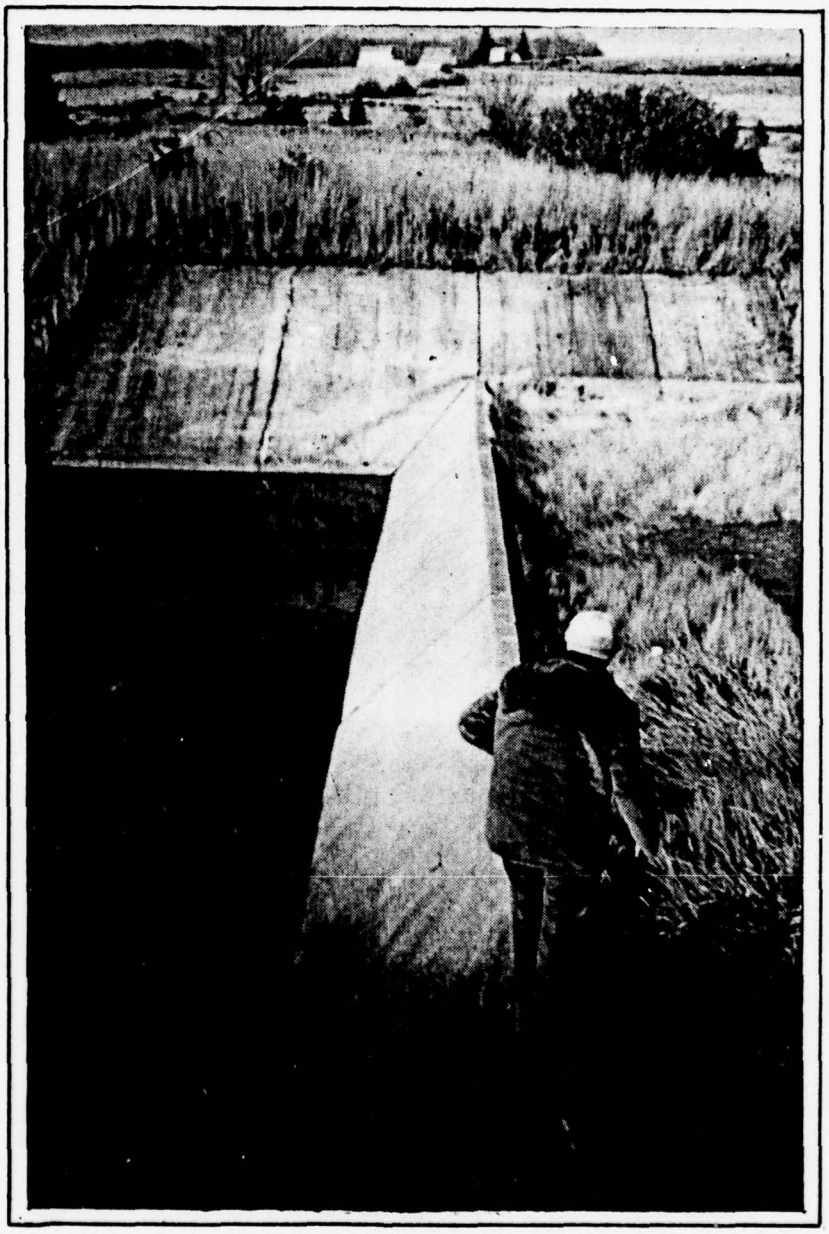
DISCHARGE CONDUIT AND WEIR FOR
PRINCIPAL SPILLWAY.

PHOTOGRAPH NO. 3



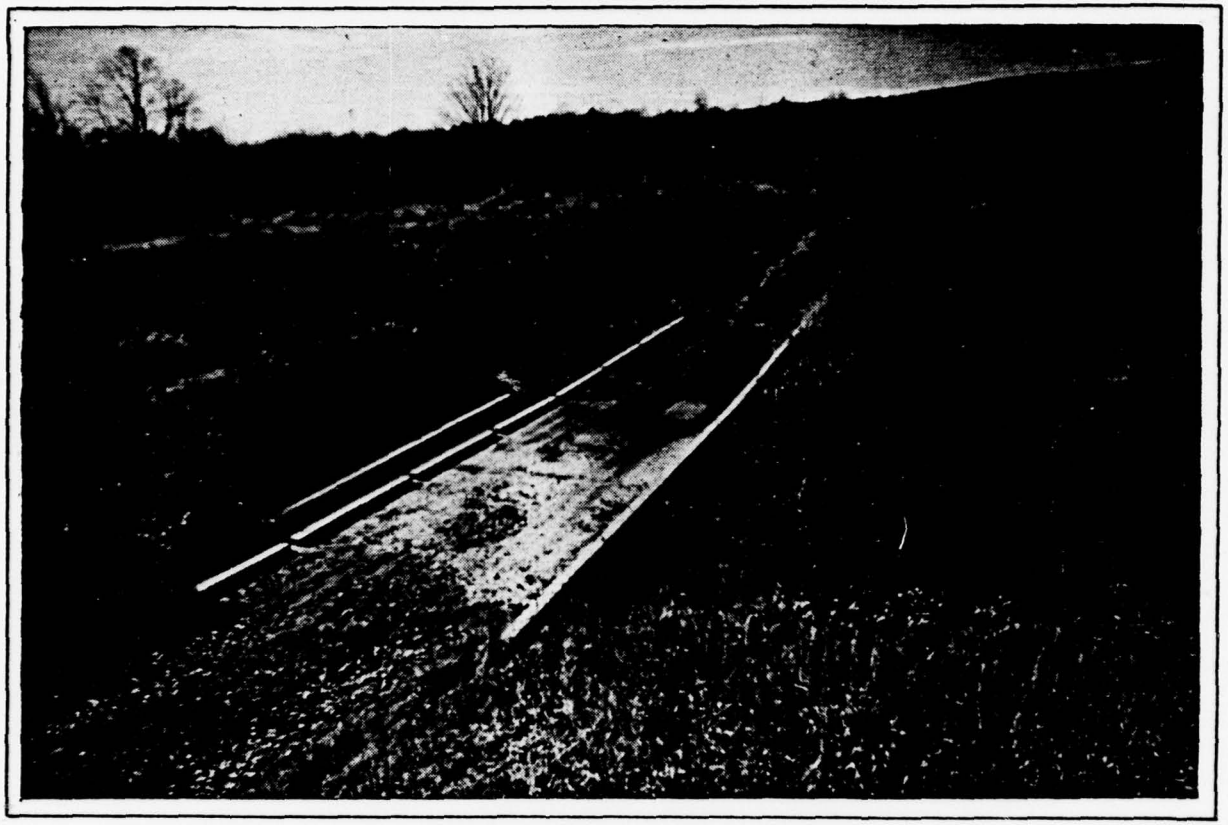
OVERVIEW OF DISCHARGE CHANNEL BELOW
PRINCIPAL SPILLWAY.

PHOTOGRAPH NO. 4



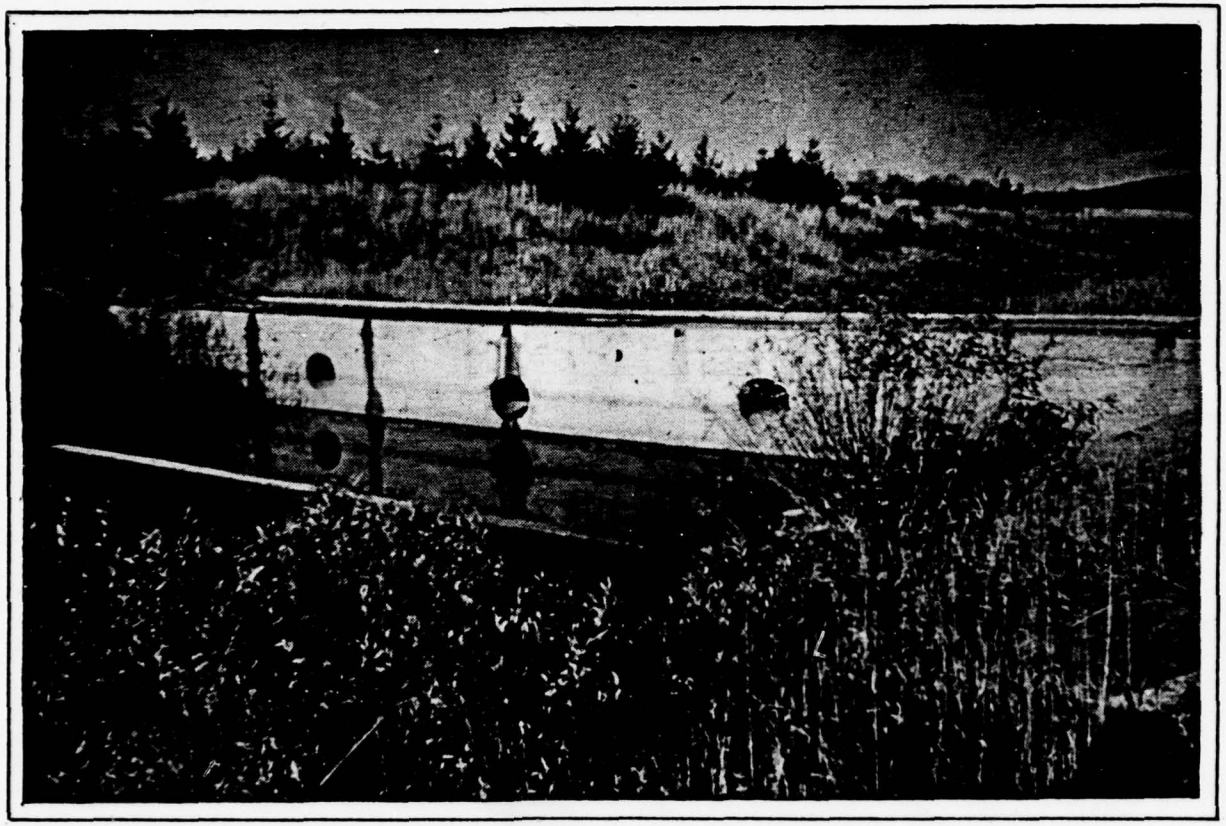
OVERVIEW OF TRAPAZOIDAL
WEIR OF EMERGENCY SPILLWAY
LOOKING TOWARDS RIGHT
ABUTMENT.

PHOTOGRAPH NO. 5



ACCESS BRIDGE BELOW EMERGENCY SPILLWAY.
RESERVOIR IS ON THE RIGHT.

PHOTOGRAPH NO. 6



DISCHARGE CONDUITS BENEATH ACCESS
ROAD SHOWN IN PHOTOGRAPH 6.

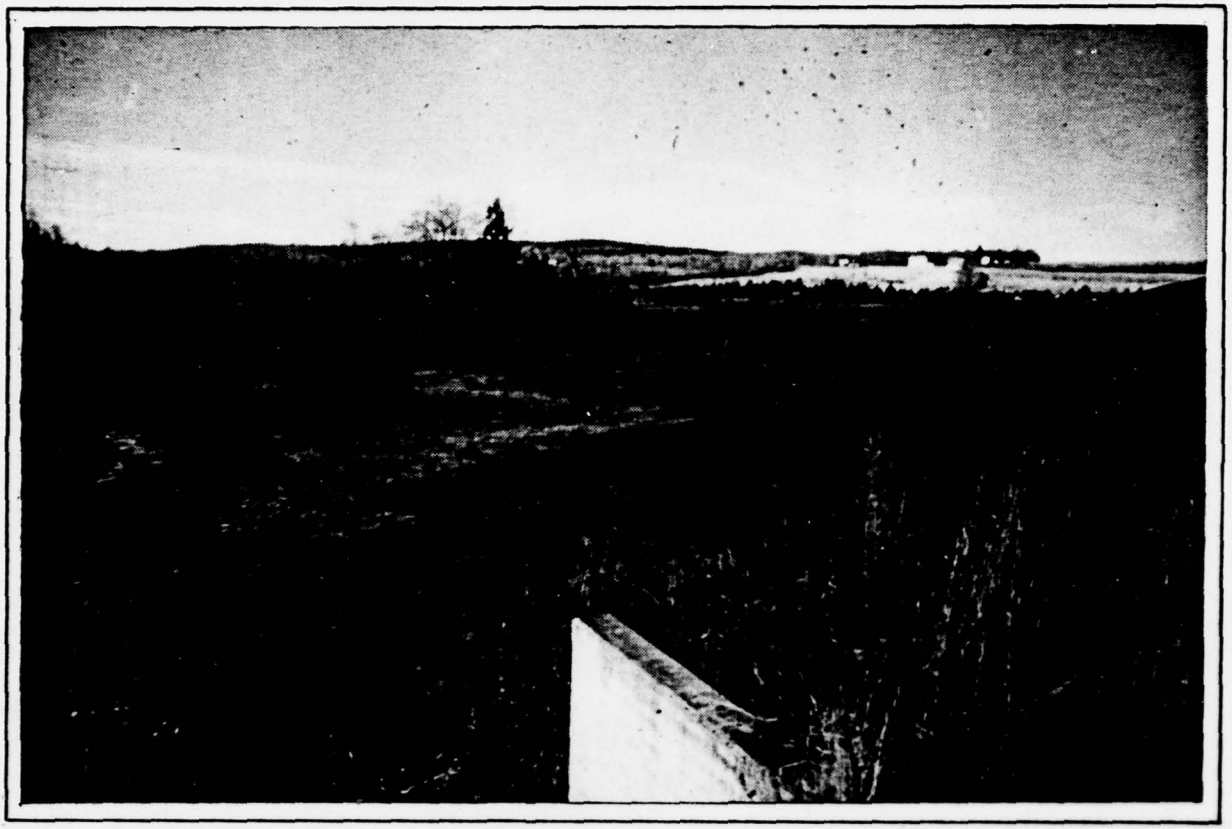
PHOTOGRAPH NO. 7

VIEW OF TYPICAL CHECK DAM CONSTRUCTION
WITHIN THE EMERGENCY SPILLWAY CHANNEL
BELOW ACCESS ROAD.

PHOTOGRAPH NO. 8

OVERVIEW OF CREST AND UPSTREAM SLOPE
LOOKING TOWARDS LEFT ABUTMENT.

PHOTOGRAPH NO. 9



OVERVIEW OF DOWNSTREAM SLOPE. NOTE DISCOLORED VEGETATION ASSOCIATED WITH TOPOGRAPHIC LOW.

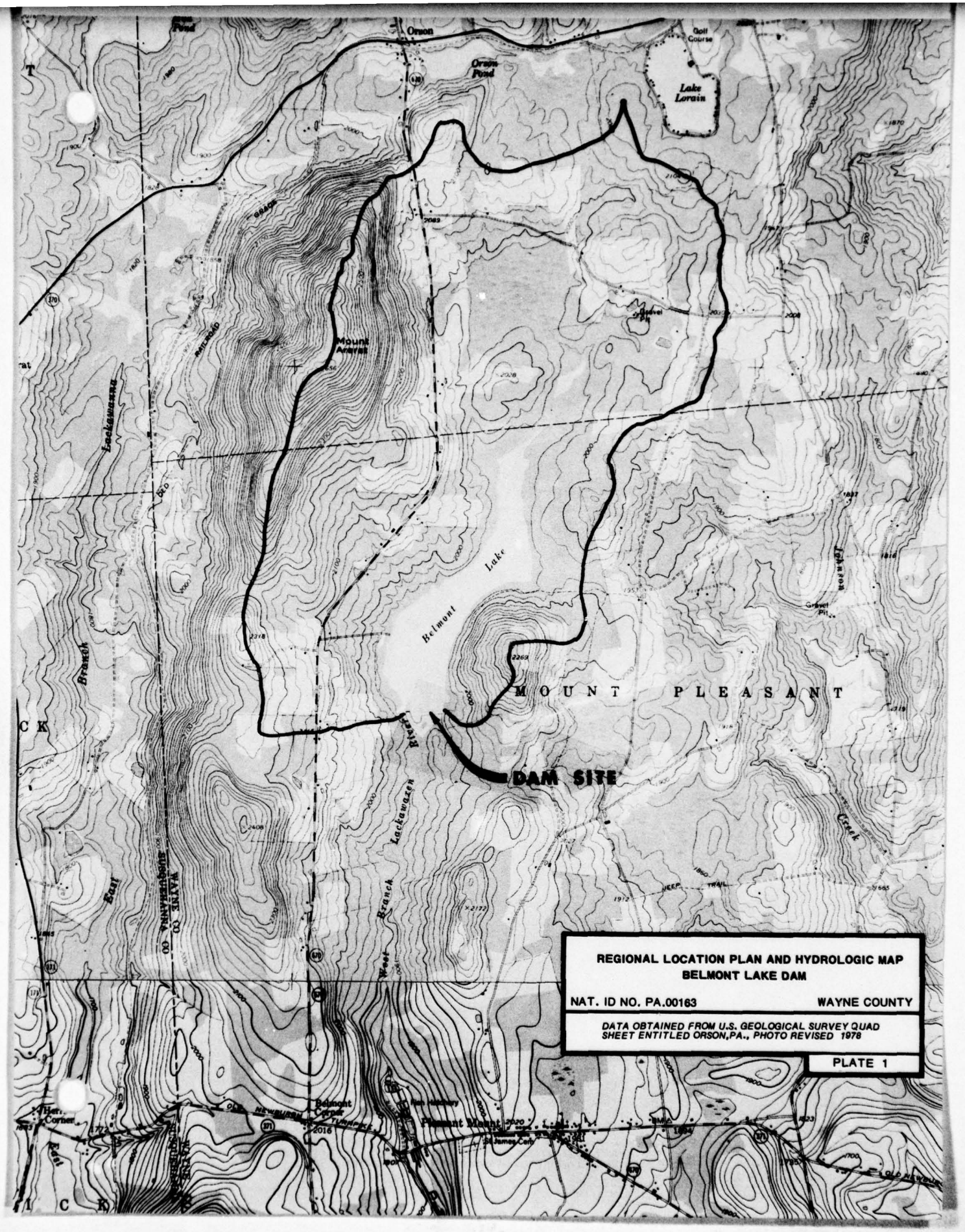
PHOTOGRAPH NO. 10

STREAM AS IT PASSES THROUGH FISH HATCHERY APPROXIMATELY TWO MILES DOWNSTREAM.

PHOTOGRAPH NO. 11

APPENDIX

E

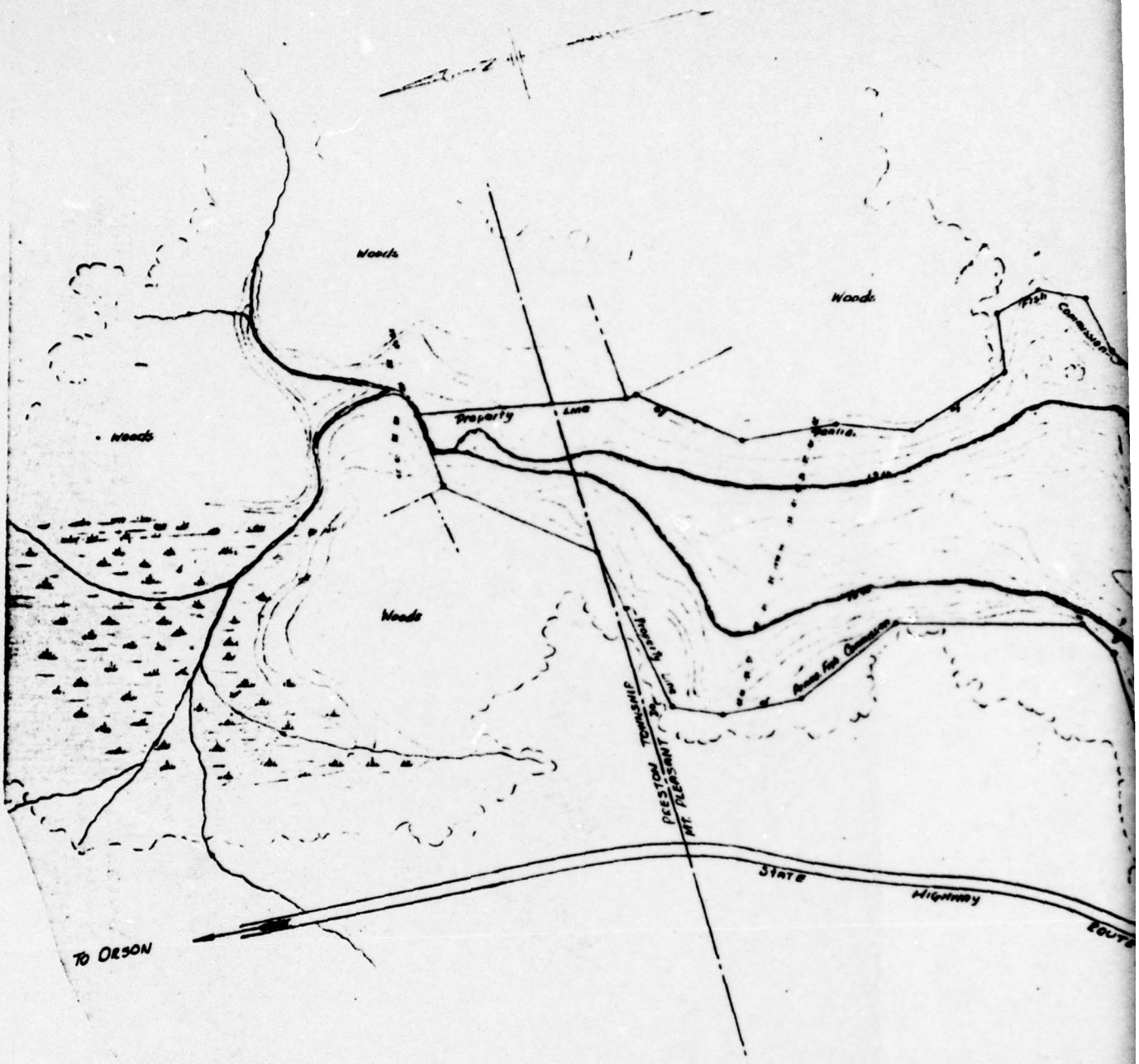


REGIONAL LOCATION PLAN AND HYDROLOGIC MAP
BELMONT LAKE DAM

NAT. ID NO. PA.00163 WAYNE COUNTY

DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY QUAD SHEET ENTITLED ORSON,PA., PHOTO REVISED 1978

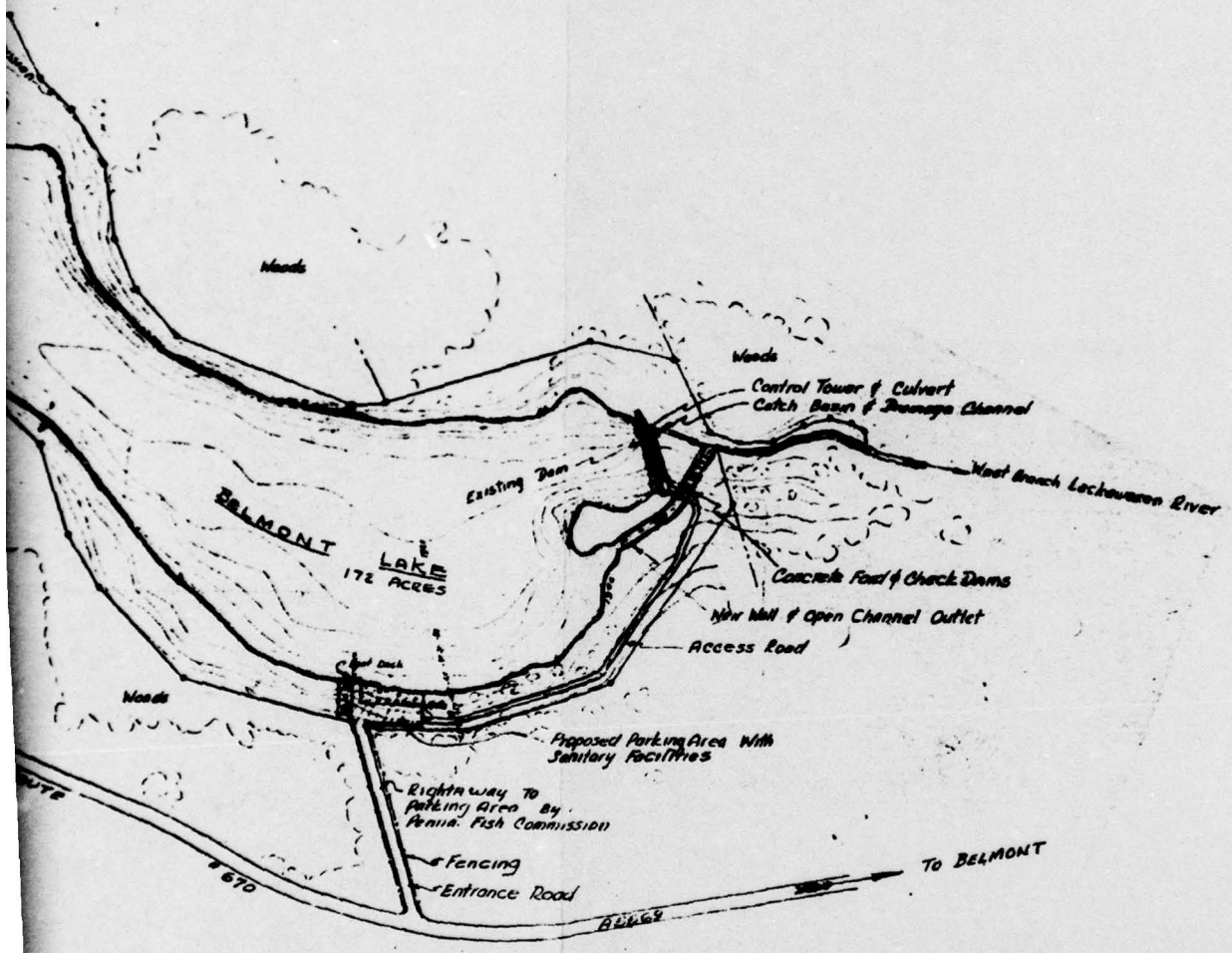
PLATE 1



TOPOGRAPHY MAP

NOTES:

1. See Sheet #2 for General Plan and Cross Sections of Dam.
2. See Sheet #3 for Cross Sections of Spillway Channel and Roads.
3. See Sheet #4 for Weir and Ford Details
4. See Sheet #5 for Control Tower and Culvert Details.
5. See Sheet #6 for Catch Basin Details.
6. All Dimensions and Measurements Shall be Checked and Verified by the Contractor at the Site.



AP

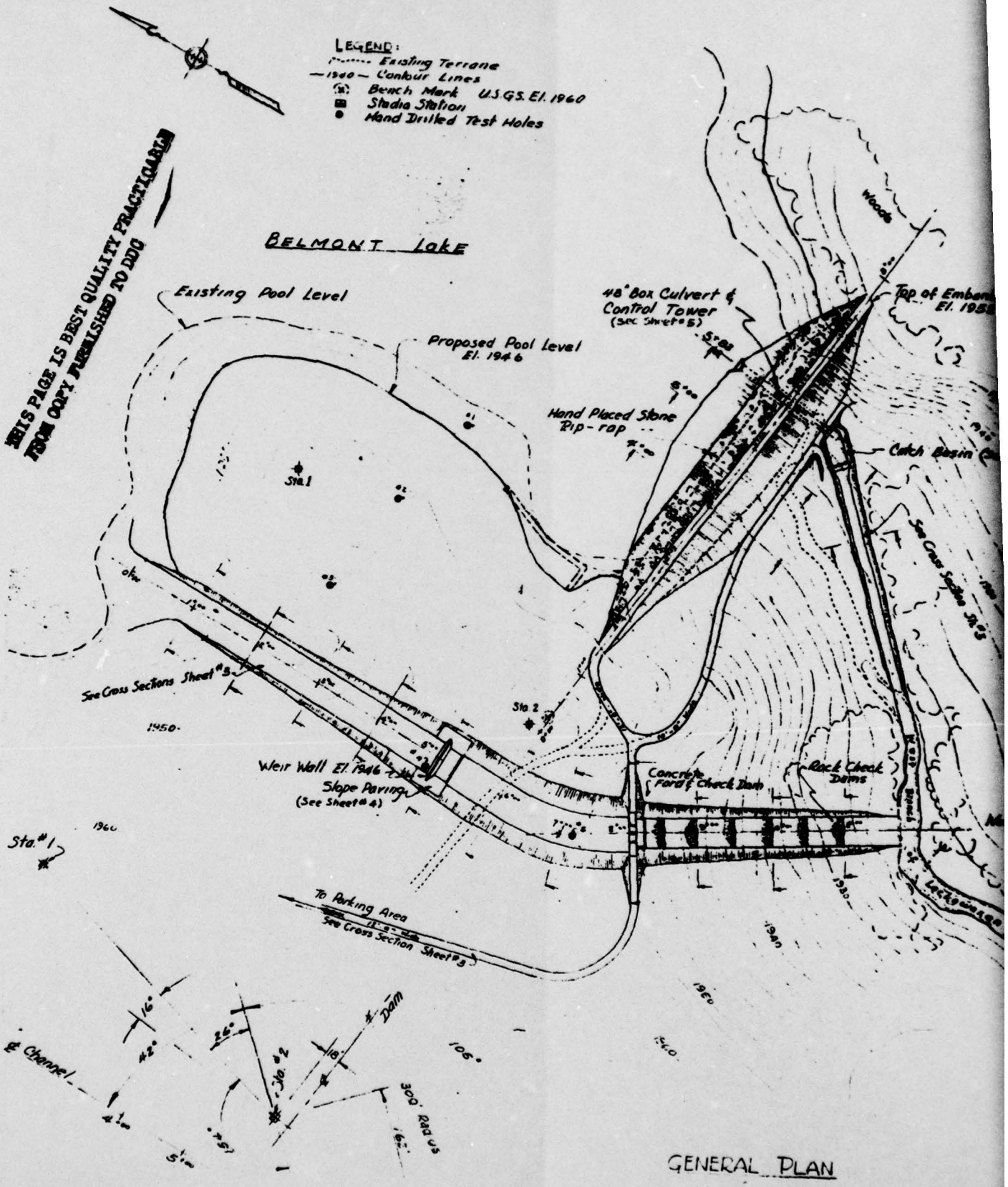
PLAN OF DAM AND RESERVOIR

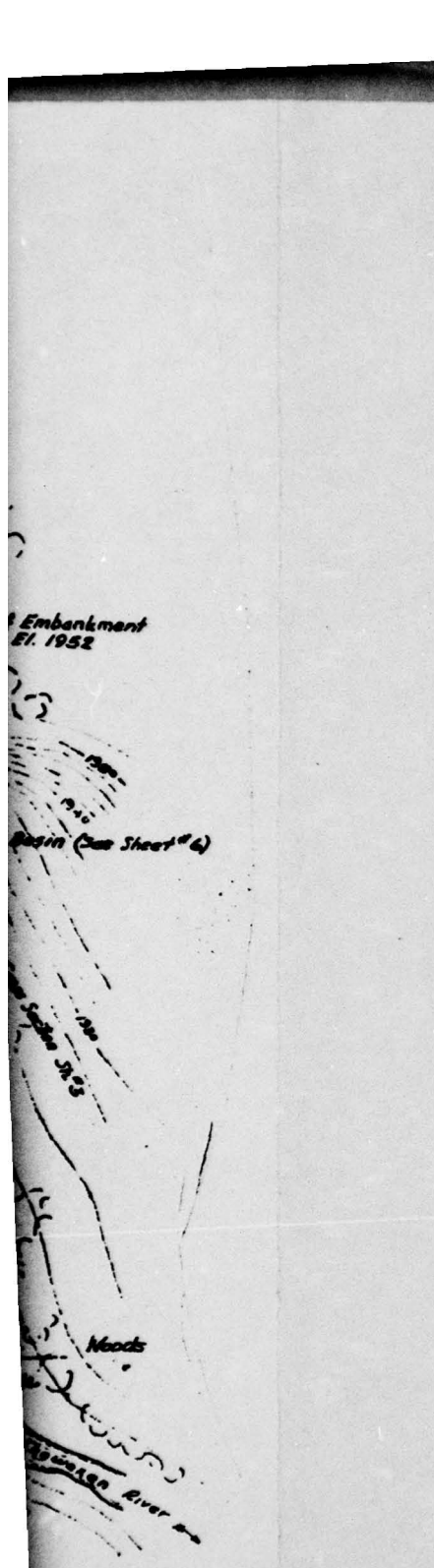
BELMONT LAKE DAM

NAT. ID NO. PA. 00163 **WAYNE COUNTY**

DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF PROPERTY AND SUPPLY, PROJECT NO. 2727-0, SHEET NO. 1 DATED 1/8/58

PLATE 2





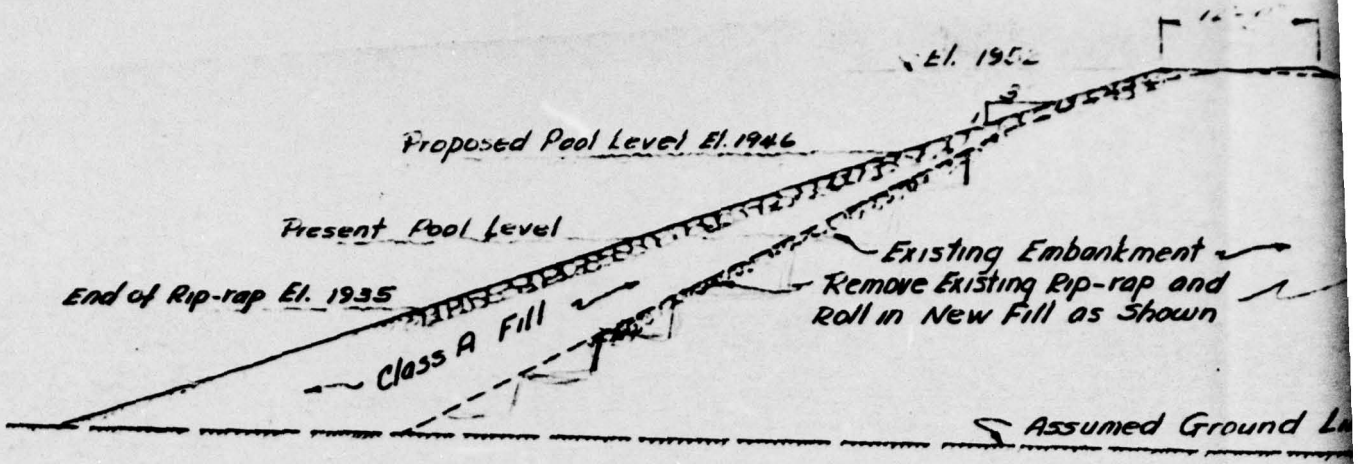
PLAN OF DAM AND APPURTENANCES

BELMONT LAKE DAM

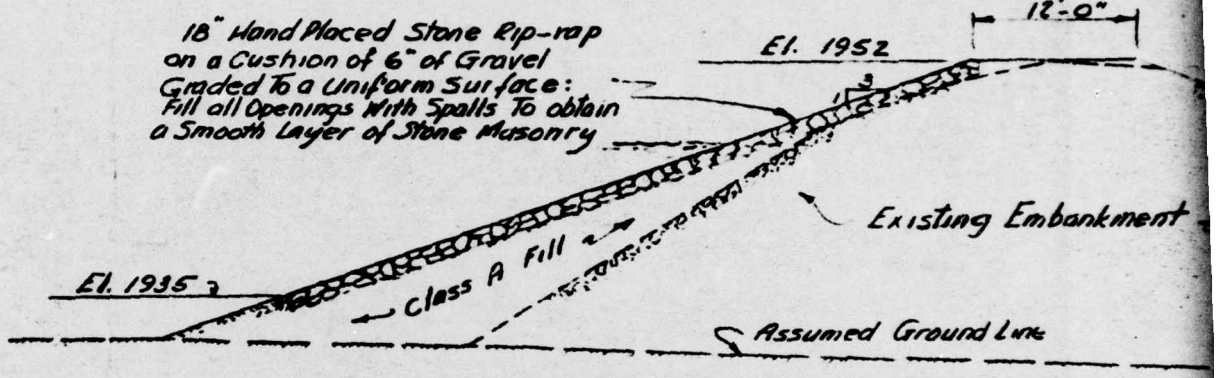
NAT. ID NO. PA.00163 WAYNE COUNTY

DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF OF PROPERTY AND SUPPLY, PROJECT NO. 2727-0, SHEET NO. 2 DATED 3/26/78

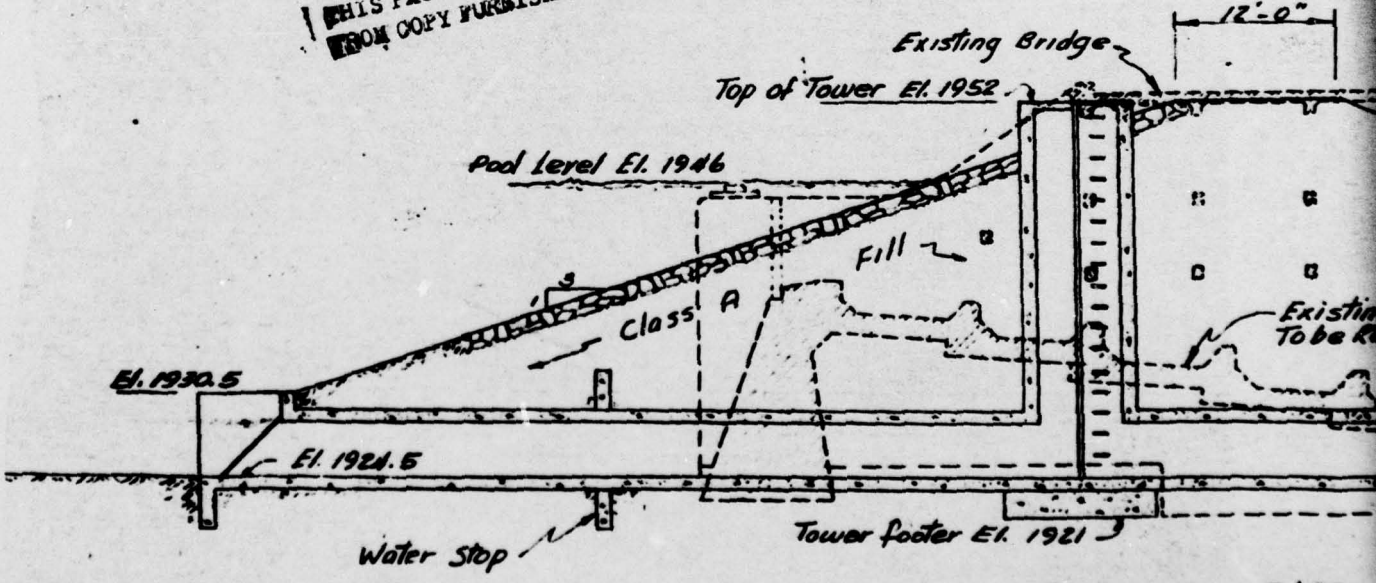
PLATE 3



SECTION at STA.
Scale 1" = 10 ft



SECTION at STA
1" = 10 ft.



SECTION at STA
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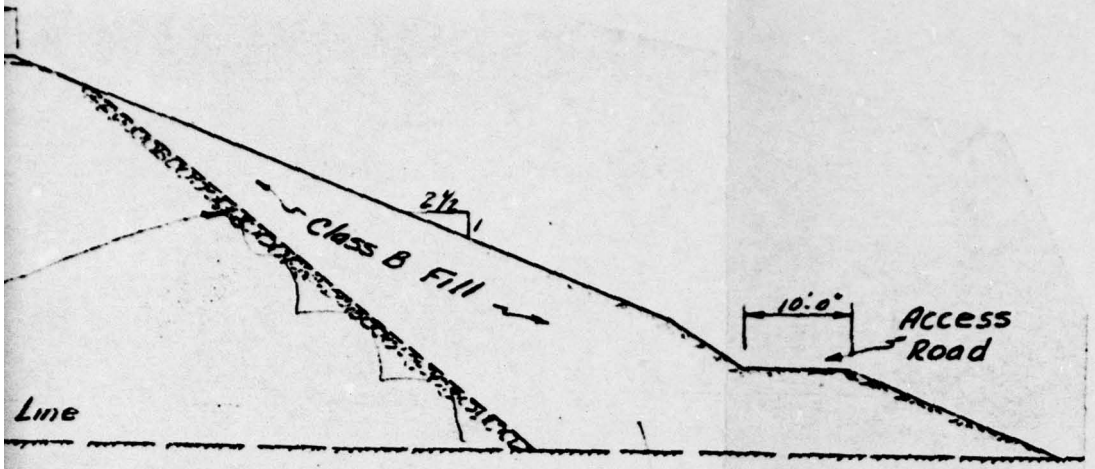
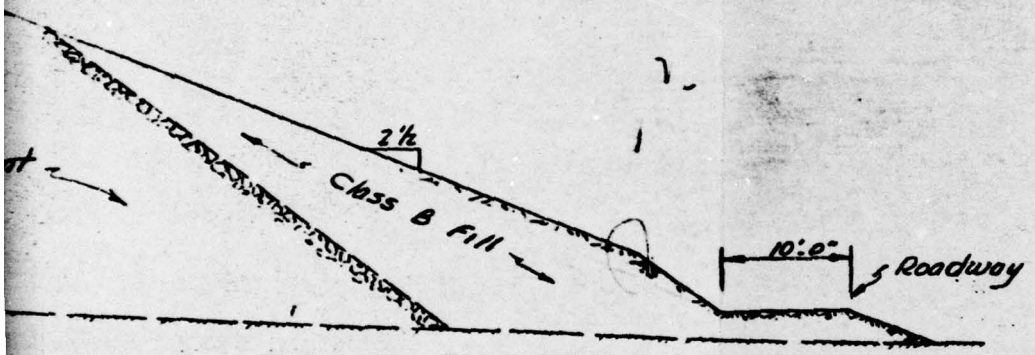
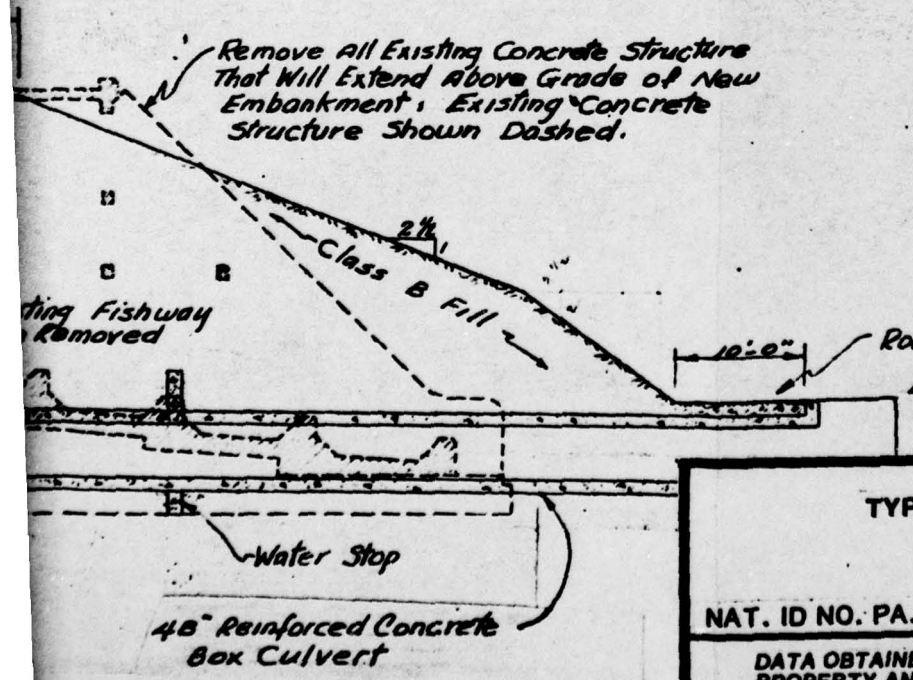


A. 5+00



TA. 4+00

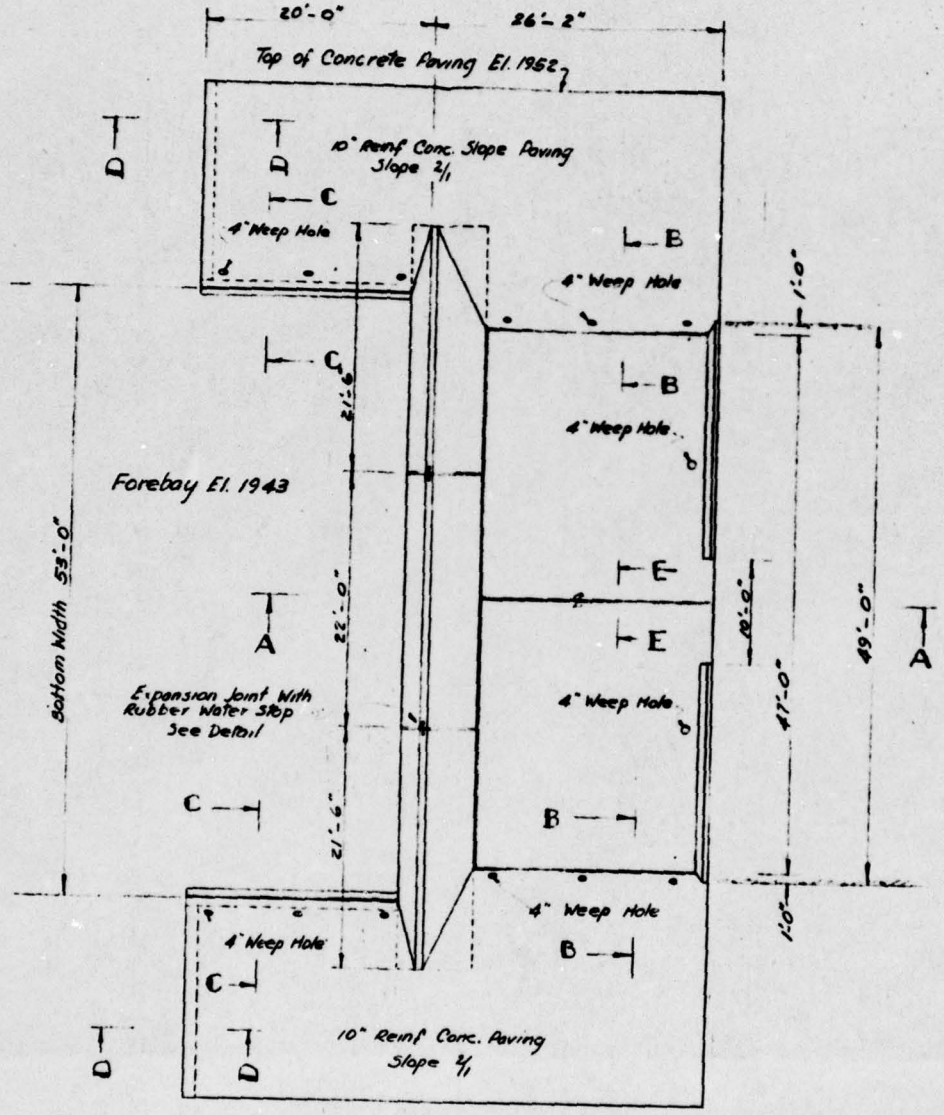


TYPICAL EMBANKMENT SECTIONS
BELMONT LAKE DAM

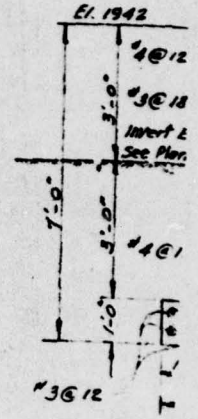
NAT. ID NO. PA. 00163 — WAYNE COUNTY

DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF PROPERTY AND SUPPLY, PROJECT NO. 2727-0, SHEET NO. 2 DATED 3/26/58

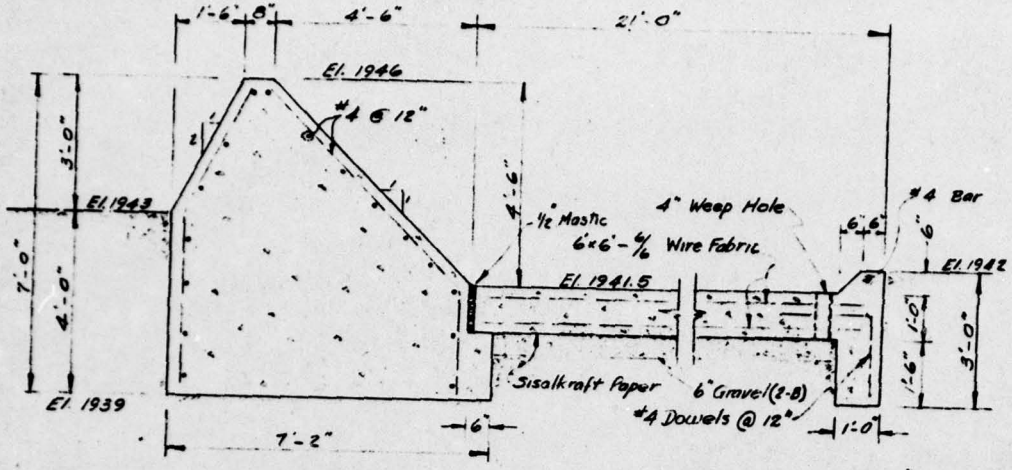
PLATE 4



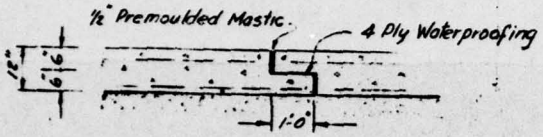
PLAN of WEIR
1/8" = 1 ft.



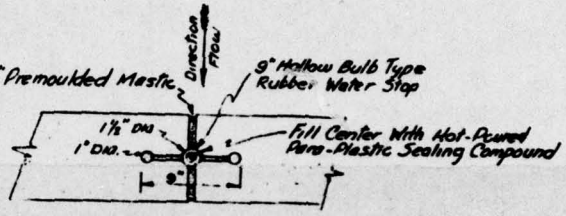
PLAN OF WEIR
1/8" = 1 Ft.



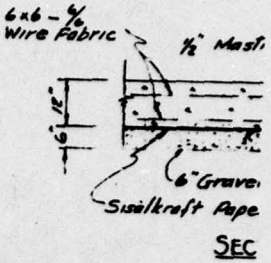
SECTION A+A
1/2" = 1 Ft.



SECTION E-E
1/2" = 1 Ft.

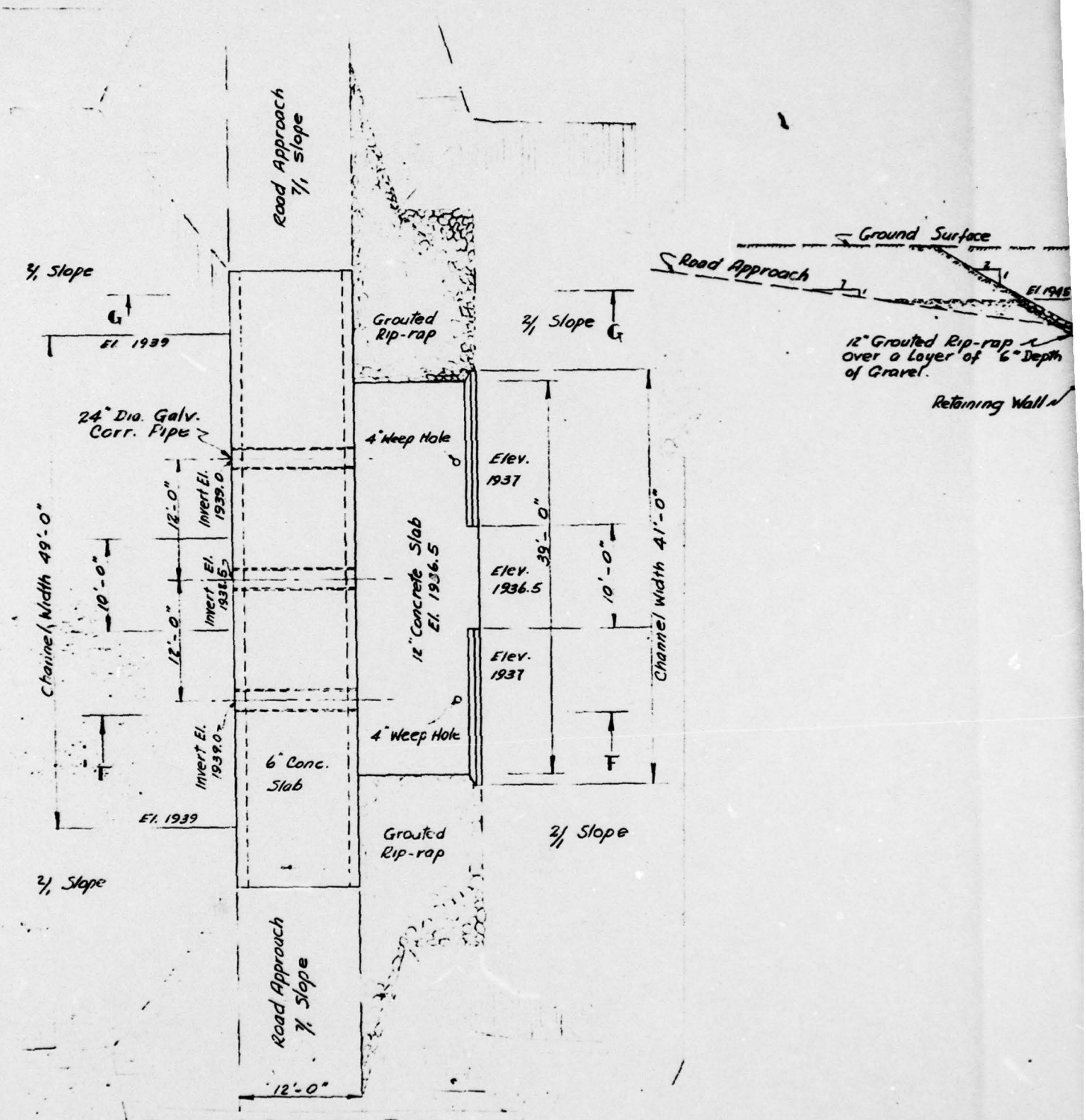


EXPANSION JOINT
1 1/2" = 1 Ft.

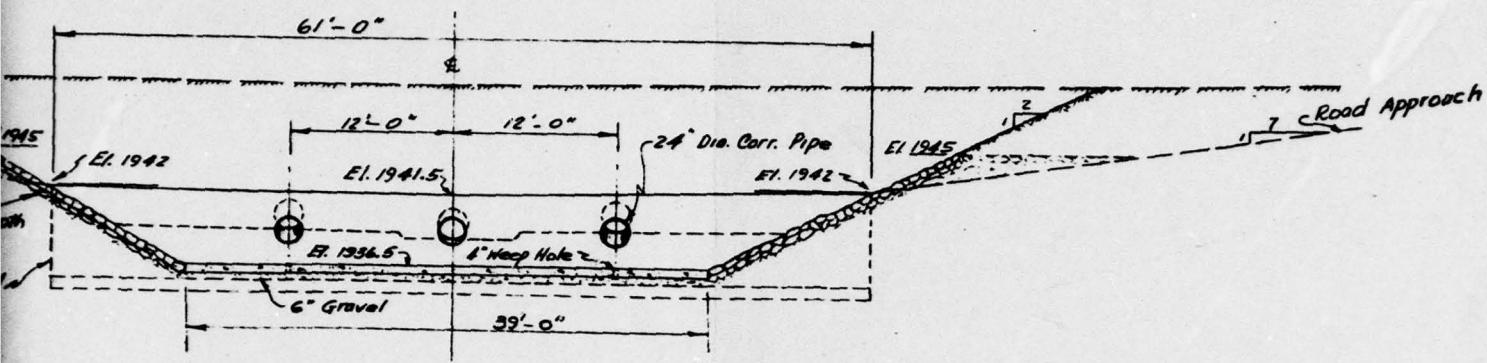


SEC

SPILLWAY PLAN AND SECTION
BELMONT LAKE DAM
NAT. ID NO. PA.00163 | WAYNE COUNTY
DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF PROPERTY AND SUPPLY, PROJECT NO. 2727- 0, SHEET NO. 4 DATED 3/20/58
PLATE 5



PLAN of CONCRETE FORD



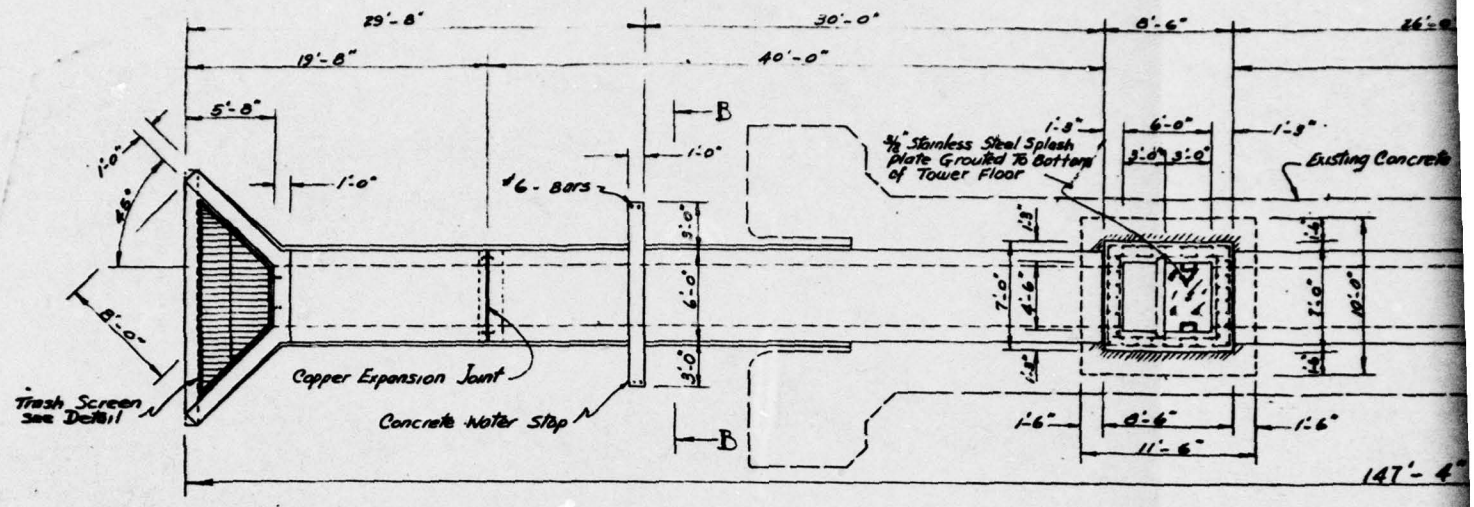
SECTION @ 8+00

SPILLWAY SECTION THROUGH ACCESS ROAD
BELMONT LAKE DAM

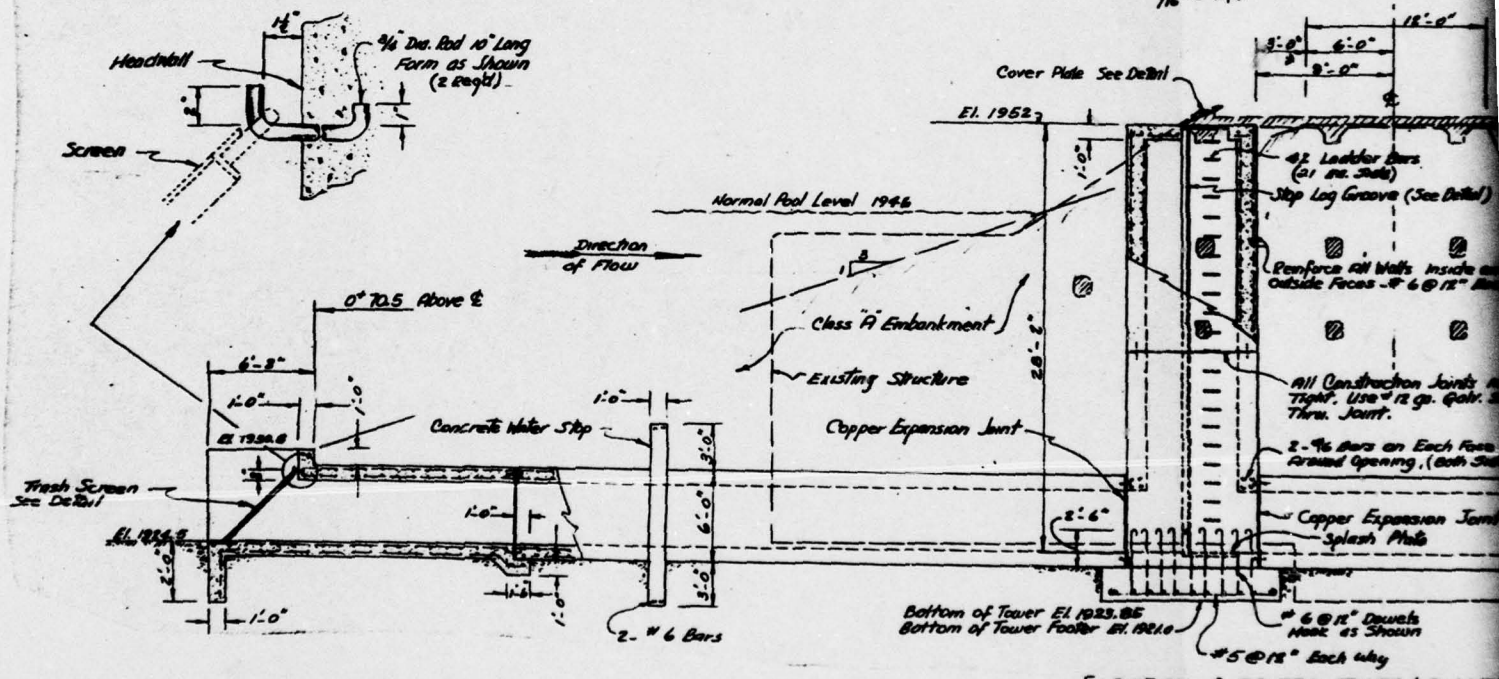
NAT. ID NO. PA. 00163 WAYNE COUNTY

DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF PROPERTY AND SUPPLY, PROJECT NO. 2727-0, SHEET NO. 3 DATED 3/26/58

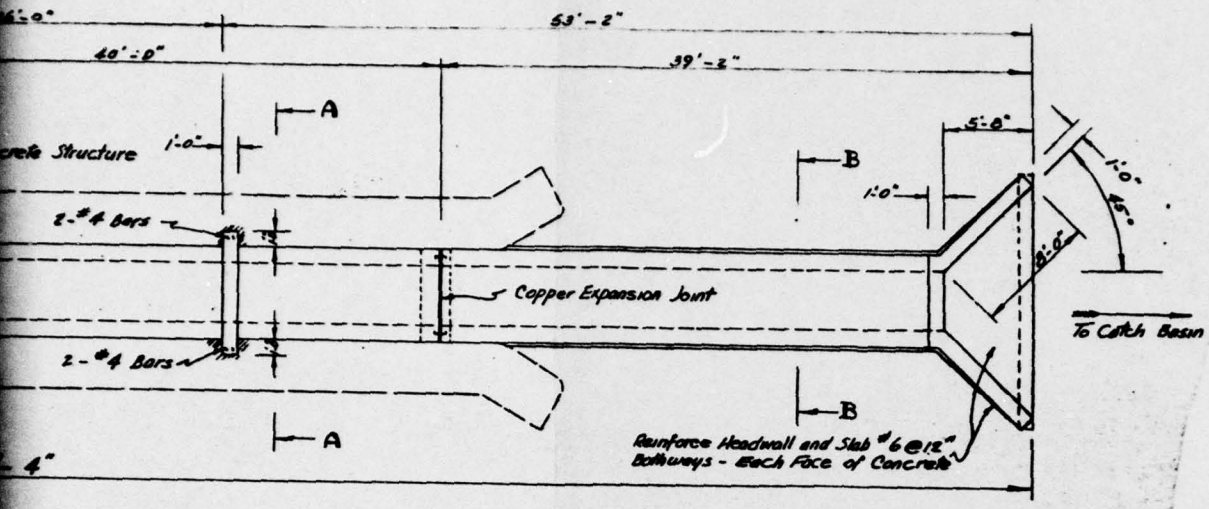
PLATE 6

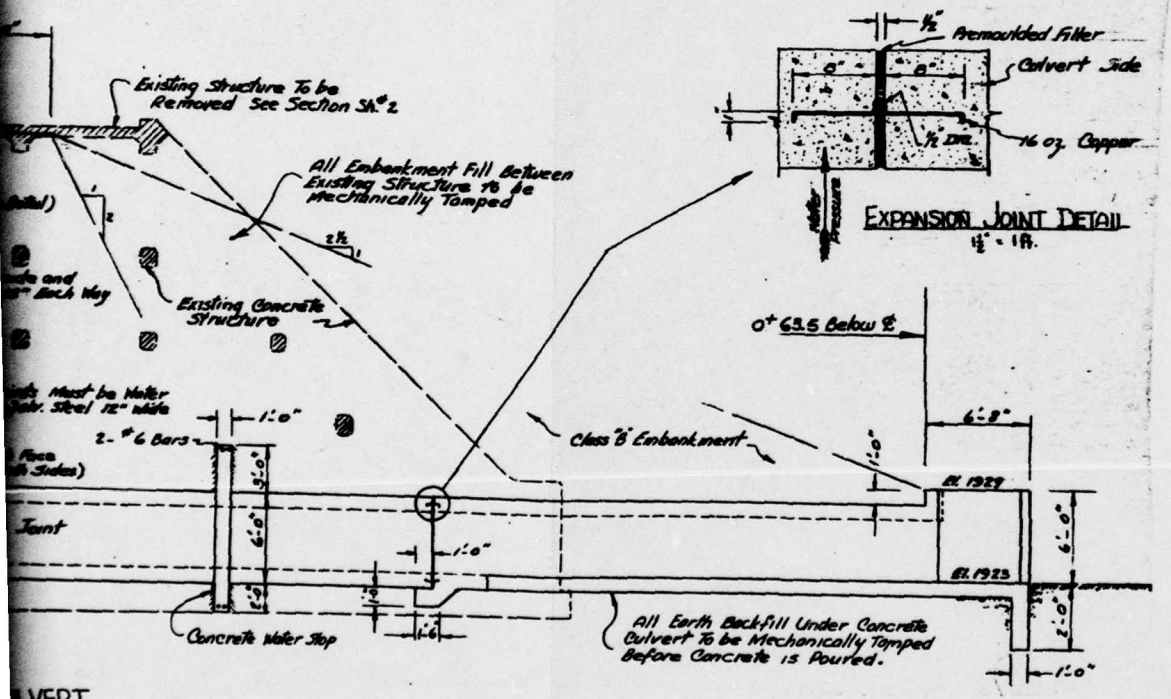


PLAN of TOWER & CULVERT
3/16" = 1 Ft.



ELEVATION of CONTROL TOWER & CULVE





LVERT

CONTROL TOWER AND CULVERT
BELMONT LAKE DAM

NAT. ID NO. PA.00163 WAYNE COUNTY

DATA OBTAINED FROM COMMONWEALTH OF PENNA., DEPT. OF PROPERTY AND SUPPLY, PROJECT NO. 2727-0, SHEET NO.5 DATED 3/25/58

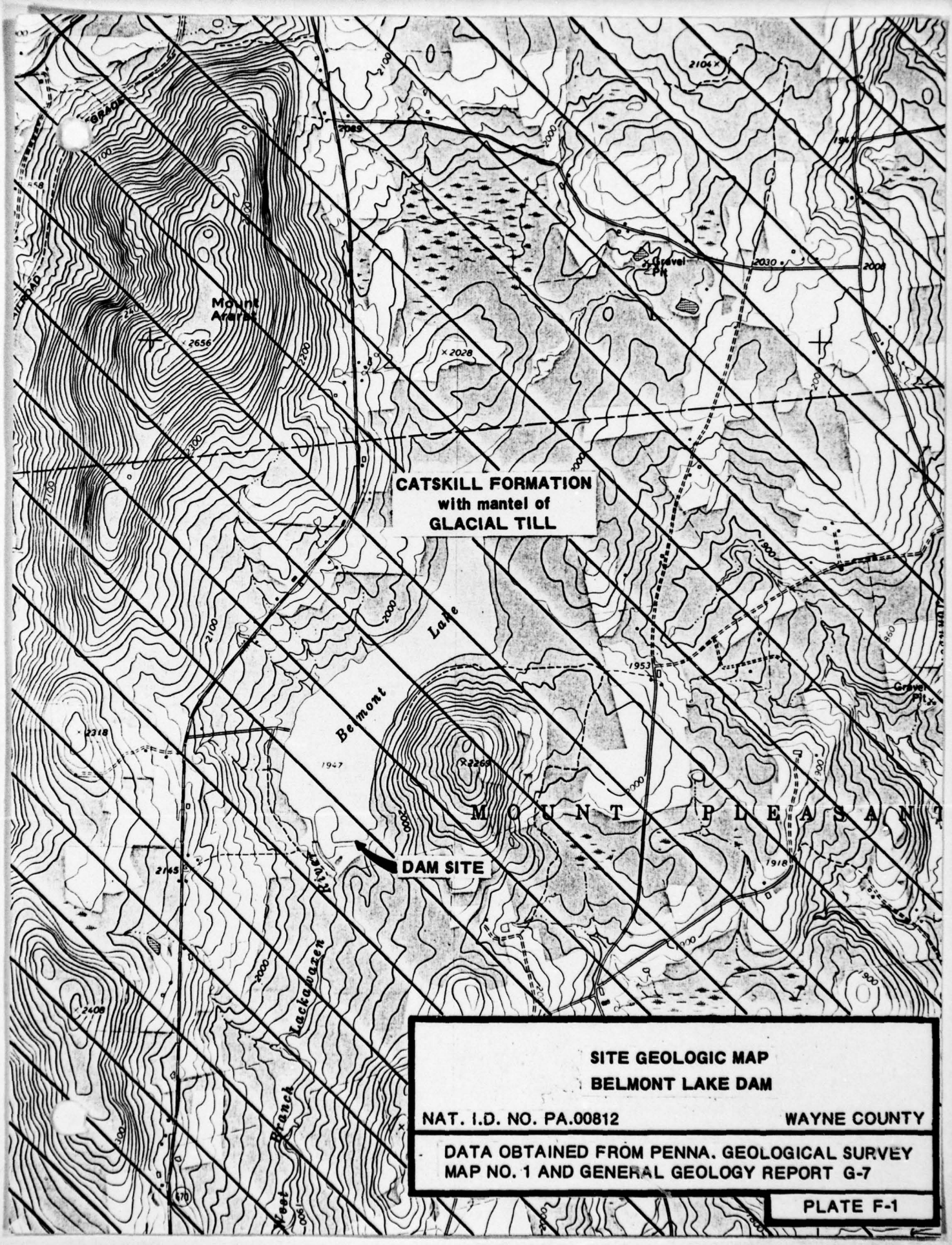
PLATE 7

APPENDIX

F

SITE GEOLOGY
BELMONT LAKE DAM

Belmont Lake Dam is located in the Glaciated Low Plateaus Section of the Appalachian Plateaus Physiographic Province. As shown in Plate F-1, the dam site and surrounding region, as is much of northeastern Pennsylvania, is underlain by the Upper Devonian Age Catskill Formation which in turn is overlain by Wisconsin Age glacial drift. A possible bedrock exposure in the dam site area consists of gray fine sandstone striking northwest and dipping less than 5° to the southwest, having jointing striking north-northwest and dipping steeply to the east. Due to the paucity of rock exposures it is unlikely that the seepage associated with rock discontinuities would be significant.



SITE GEOLOGIC MAP
BELMONT LAKE DAM

NAT. I.D. NO. PA.00812 WAYNE COUNTY

DATA OBTAINED FROM PENNA. GEOLOGICAL SURVEY
MAP NO. 1 AND GENERAL GEOLOGY REPORT G-7

PLATE F-1